

Master thesis

# **BICYCLE COMMUTING TO UNIVERSITY OF FLORIDA CAMPUS**

REALIZING A MODAL SHIFT AT THE HEART OF THE GATOR NATION



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# Abstract

This research attempts at investigating what can be done to increase bike-use for commuting to and from University of Florida campus in Gainesville, FL. Cycling offers the benefits over motorized transport of being non-polluting, alleviating traffic congestion and environmental damage, and bringing routine physical exercise that provides the cyclists with important health benefits. While the campus of University of Florida represents a key destination for commuters in Gainesville, bicycle commuting only represents a minor share of the traffic to and from campus. It thus makes sense to investigate how more of these commuting trips can be done by bike.

First the factors that lead to the decision to commute by bike or by car are investigated, as understanding decision-making behavior offers insights in how decisions can be influenced. This is done through a survey including both bike and car commuters. Second, the experience of people already commuting to campus by bike is investigated, to understand factors that facilitate or obstruct the bicycle commute. This is done through a GPS/Interview method, combining in-depth interview with bike commuters with GPS data and video footage from their commute.

The main findings of the research are that the decision to commute by bike is largely influenced by attitudes towards personal benefits of cycling such as convenience, speed, comfort, cost and health-benefits, rather than consideration of the environment. Safety and convenience are crucial to the bicycle commute, and decisive factors in the choice to commute by bike or not. Car commuters are not negative towards the idea of cycling to campus, but they are obstructed by both the (deficiency of) available infrastructure where they live, and a lack of confidence in their own cycling experience and skills amongst other traffic. Origin-destination mapping of survey participants confirms that car commuters tend to live in areas where bike infrastructure is underdeveloped. Safety is a recurrent theme throughout the research, and equally mentioned by interviewees as the main issue influencing the commute. This safety is influenced by both the bike infrastructure available and the behavior of other traffic.

Recommendations are made in the concluding section of research. The decision to commute by bike is shaped by two trade-offs: one between the benefits of cycling versus the benefits of driving to campus, and one between the benefits of commuting by bike versus the costs of commuting by bike (safety hazards, physical exercise, harsh climatic circumstances). Key to getting drivers to bike is to emphasize that it offers multiple personal benefits, and make insightful that these personal benefits outweigh those of coming to campus by car. Furthermore, the personal benefits of commuting by bike have to outweigh the costs of it. Car commuters have to experience these benefits themselves and come to the conclusion that it outweighs the costs. Lowering the bar to commute by bike should thus be done through strategic construction of adequate and continuous bike infrastructure where cyclists can have a comfortable commute protected from other traffic and climatic conditions. In addition, education on cycling for potential cyclists and on how to deal with bikes as an automobilist, are measures that would help normalize the bike as an everyday transport mode and help in realizing a modal shift towards bicycle commuting in Gainesville.



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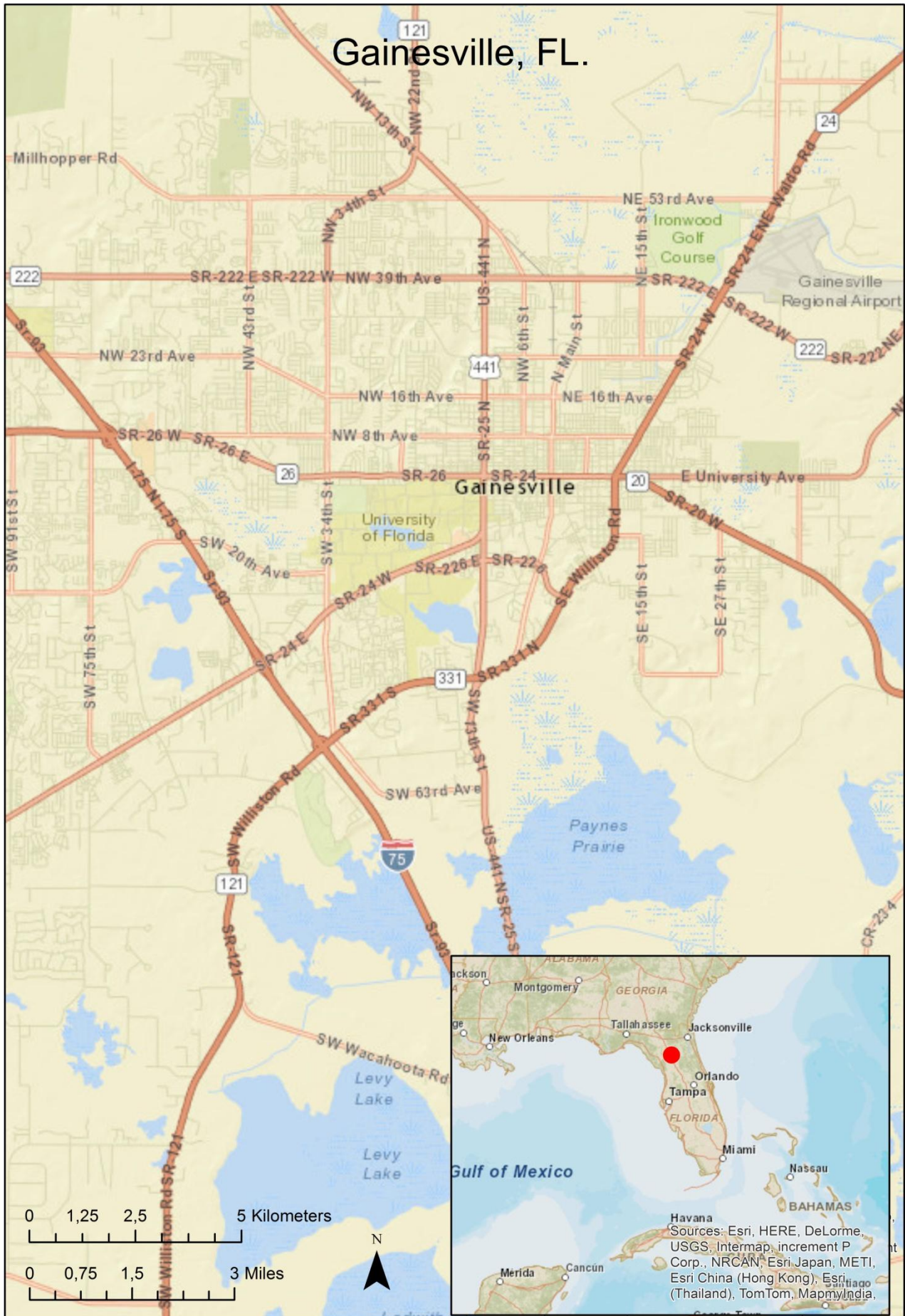
## Area of study

The area of study of this research is the city of Gainesville, FL. The city is located in North – Central Florida, and is the county seat of Alachua County. It is home to the University of Florida, Florida's oldest university, the leading employer in Gainesville and one of the state's centers of education, medicine, culture and athletics. The alligator is the symbol of the region, and gives the University of Florida intercollegiate sports' teams the nickname *Florida Gators*. The University of Florida and the Gainesville area are referred to as the 'Gator Nation', which was the inspiration for the subtitle of this document.

The campus of University of Florida is located west / south-west of downtown Gainesville (see map on opposite page) and roughly bordered by State Road (SR) 26 (W University Avenue) to the north, SR 24 W (SW Archer Road) to the south, SW 34<sup>th</sup> Street to the west and SW 13<sup>th</sup> Street to the east.



# Gainesville, FL.





# 1. Introduction

This research focuses on commuting by bicycle in the United States of America. While cycling offers considerable environmental, economic and societal advantages over the use of motorized transport and personal automobile transport in general, only around 0.6% of all commuting trips in the United States are done by bicycle (Swanson, 2012). This is a low percentage compared to other industrialized countries such as in Europe (ECMT, 2004). From a historical perspective, this can be explained by 20<sup>th</sup> century, post-war spatial planning developments in the United States that led to an automobile-oriented society, with the car favored over other modes of transport. Several developments played part in this, such as functional zoning, finance mechanisms leading to sprawling housing developments, and federal highway developments (Silver, 2006; Peterson, 2003; Dreier & Atlas, 1996; Weingroff, 2000). However, there is a mounting body of evidence on the positive effects of cycling on environmental pollution, traffic congestion and health (Buehler & Pucher, 2012). Even though the percentages for bike commuting vary greatly among different regions and U.S. metropolitan areas, the question why so many Americans choose the car over the bike, even for shorter distances, is increasingly interesting. A mode shift towards forms of non-motorized transport is essential in moving towards more environmental, societal and economical sustainable societies in the future.

One of the most serious challenges facing the global human population today is global climate change. Vitousek (1994) argues that global climate change is driven by “the rapidly growing human population and our high rates of resource consumption” (p1862). Expansion of the global human population and its increased resource consumption has led to increased release of anthropogenic (man-made) greenhouse gases by 70% between 1970 and 2004. Carbon dioxide (CO<sub>2</sub>) is considered among the main drivers of climate change (Intergovernmental Panel on Climate Change, 2007). In the United States in 2011, 28% of the total CO<sub>2</sub> emission came from burning fossil fuels for transportation purposes (United States Environmental Protection Agency, 2013). Private transportation is the most important source of emission through burning of fossil fuels. Of this private transportation, the U.S. Department of Transportation estimates that in 2011, 83.4% of all trips were made using private vehicles (2013). Bamberg et al (2010) state that the excessive use of private automobiles is the root of many environmental problems. Not only does this concern the emission of greenhouse gases and its longer-term effect upon global warming, but consequences influencing people’s daily lives in an even more direct way: air pollution, higher noise levels, traffic congestion, parking problems, and consequences for population health.

As a consequence, many national governments, and lower administrative levels such as cities and towns, are now making efforts to change transport mode choice of citizens by emphasizing more environmental-friendly and healthy modes of transport. Cavill et al (2008) note that “the promotion of cycling and walking has become an area of emerging interest and high relevance to the development of comprehensive health and environmental policies; in particular those related to the implementation of sustainable transport policies. These sustainable transport policies are directly aimed at environmental sustainability, but address a wide array of issues: with this environmental sustainability come the issues of economic and societal sustainability.

While public transportation is often considered an essential element of these sustainable transport policies, it is still motorized transport, over which walking and cycling offer some distinct advantages. Pucher & Buehler (2010) sum up the benefits of walking and cycling over motorized transport in general: they cause no noise or air pollution; they use only a fraction of nonrenewable resources motorized transport uses; energy is provided for by the traveler -which has considerable advantages for public health -; they use a fraction of the space required by motorized transport; they cost far less than motorized transport; and both walking and cycling are affordable by virtually everyone. “In short, it is hard to beat walking and cycling when it comes to environmental, economic and social sustainability” (Pucher & Buehler, 2010).

While walking instead of using the car offers the same environmental, health and cost-benefits as cycling, the bike offers the relative advantage of being faster and more convenient for bridging longer distances. As such, short distances that are harder to cover walking might be covered by cycling in a way that is more time-effective. For instance, a comparison of levels of walking and cycling in the Netherlands and Denmark reveals that the relative percentage of people walking instead of biking decreases with increase of distance (Swanson, 2012). Therefore, in this research the focus will be on the bike as an environmental friendly, healthy, convenient and cost-effective alternative to the private automobile for within-city, short-distance commuting purposes.

The aim of this research is to compare car and bike user behavior and attitudes towards bicycle commuting, and assess the daily experience of bicycle commuters in order to propose changes to increase bike use. The research focuses upon commuting to and from the campus of the University of Florida (UF) in Gainesville, FL. University campuses traditionally are major commuting trip attractors: however, only a minority of commuting trips to and from UF campus are done by bicycle. This is despite different policies and measures that have already been put into place to increase levels of cycling in Gainesville. Focusing specifically upon commuting to UF campus has two advantages. First, commuting plays a unique role within the mix of overall trips due to its spatially and time-bounded character. Second, UF campus is both a major trip attractor in Gainesville and a spatially delimited unit. Studying commuting to and from campus thus offers a convenient target, which might prove to be a good starting point to address an increase of the overall modal share for cycling in Gainesville. The aim, objectives and research questions that are central to this thesis are outlined below.

*Aim* – the intention of the research project is to:

- Compare car and bike user norms and attitudes towards bicycle commuting, and assess the daily experience and behavior of bicycle commuters in order to propose changes to increase bike use.

*Objectives* – the above aims are to be accomplished by;

- Getting to understand the choice for mode of transportation by comparing the norms and attitudes of car and bike users towards commuting by bicycle
- Investigate what factors influence cyclists' daily commute to University of Florida campus
- Assess what could be done to make it easier to commute by bike and stimulate more people to make the decision to commute to campus by bike

*Research questions;*

What changes can be made in order to increase bike-use for commuting to and from UF campus in Gainesville?

- Sub question 1: How do norms and attitudes towards bicycle commuting differ between car and bike users?
- Sub question 2: How does commuting behavior differ between car and bike users?
- Sub question 3: What factors influence cyclists' daily commute to UF campus?
- Sub question 4: What can be done to increase the attractiveness of commuting by bike and stimulate more people to commute by bicycle?

The following section provides a background to this research. First, commuting will be discussed in general. Then, the focus will evolve to commuting by bicycle, cycling in Gainesville, and cycling to University of Florida campus more specifically. Section 3 addresses the theoretical background, explaining the theories used in combination with the research questions and the conceptual model. Section 4 extends upon research methods, outlining research design, structure of methodology, ethical issues and positionality of the researcher. Section 5 addresses the results of the survey and GPS-interview sessions. Section 6 provides the conclusion, a discussion and a reflection upon the research process and results. Throughout the text, references will be made to the appendices: these can be found starting on page 69.



## **2. Background**

### **2.1 Commuting**

Commuting represents the regular travel of a person from home to work or full-time study. Place of work or study refers to the geographic location of the worker's or student's job, elsewhere than home (U.S. Census Bureau, 22-05-2012). A 2011 report by the United States Census Bureau on commuting trends estimates that almost 20 percent of all trips taken in the United States in 2009 were for commuting purposes (U.S. Census Bureau, 2011). However, commuting plays a unique role within the mix of overall trips. Heinen et al (2010) state that commuting is a mobility pattern that for most people is fixed in time and place. Commuting generally takes place twice a day, within predictable time-spans. Furthermore, commuting is often bound to a limited spatial scale, for example, within or between towns, cities and counties. This concentrated character of commuting makes that it contributes to traffic congestion and environmental pollution in a disproportionate way (2010, p60). Traffic congestion caused by commuting leads to longer commuting time for the same distances, inadequacy of public transport, difficulties for non-motorized transport, increased energy consumption and associated detrimental environmental impacts, among others (Rodrigue, 2013). It thus makes sense to investigate ways in which commuting can take place in more environmental and societal friendly and economically beneficent ways.

### **2.2 Commuting by bicycle**

As touched upon earlier, commuting by bike offers distinct environmental and societal as well as personal benefits compared to commuting by automobile. Among these is the fact that the bike is a non-polluting transport mode that helps to improve air quality and helps alleviate automobile-related problems such as traffic congestion and associated environmental damage, and the routine physical exercise that provides the cyclist important health benefits (Pucher & Buehler, 2010; Stinson & Bhat, 2004; Stinson & Bhat, 2003). Despite this, in the United States only 0.6% of all commuters use the bicycle, while 91.5% of all commuters travel by private car (Swanson, 2012). Given the fact that half of all commuting trips made in the United States are less than 5 kilometers, and as such are within the cycling range for most adult (Moritz, 1999), it seems that cycling could be a viable commuting alternative to using the car in many cases. However, the propensity to commute by bicycle might be influenced by many different factors, such as socio-economical, geographical, environmental and climatological factors (Barnes et al, 2005; Brandenburg et al, 2007; Cervero, 2002; Chen & McKnight, 2007; Crane, 2000; Pucher, 2001; Pucher & Buehler, 2006; 2010; Pucher et al, 2011) and psychological and behavioral factors (Bamberg et al, 2010; Broach et al, 2012; Daley & Rissel, 2010; Dill & Voros, 2006; Gatersleben & Appleton, 2006; Heath & Gifford, 2002; Heinen et al, 2010). These factors will be discussed in more detail below.

### **2.3 Cycling in Gainesville**

This research focuses upon bicycle commuting to the campus of the University of Florida in the city of Gainesville, Florida. Gainesville is the largest city and county seat of Alachua County, located in North-Central Florida (City of Gainesville 2014). Alachua County and Gainesville have a long history of accommodating cycling amongst other conventional transportation modes: in 1983, the City of Gainesville established a local Bicycle/Pedestrian Program. This program has had as purpose to encourage cycling through on and off-road network development, bicycle supportive policies, bike-riding promotion and education (Alachua County MTPO, 2001, p54). Furthermore, bicycle count information has been collected annually for 17 years by the Metropolitan Transportation Planning Organization for the Gainesville Urbanized Area (MTPO) from 1982 to 1999, and every five years from 1999 to 2009. The purpose of these counts, and the 2009 Bicycle Usage Trends Program resulting from the 2009 count, is to "establish a historical record of bicycle activity within the Gainesville Metropolitan Area

by collecting, monitoring and reporting bicycle activity information” (North Central Florida Regional Planning Council, 2009). This information is in turn used to develop and evaluate bicycle planning strategies.

In 2001, the Alachua Countywide Bicycle Master Plan was completed and put into effect by Alachua County and the City of Gainesville. The program is intended to lead to expanded developments of bicycle facilities and programs that will serve the needs of Alachua County residents. The focus is upon the expansion of on-road bicycle facilities, off-road trails and improving safety conditions, as to effectuate a modal shift towards cycling. The Master Plan identifies priority road segments for bicycle facility construction based upon a ranking method. The ranking is based upon the four steps: first, identification of current cycling conditions, incorporating road sections’ roadway width, bike lane width, striping, traffic volumes, pavement surfaces, etc. Second, analysis of bicycle travel demand, identifying potential bicycle trips between origins and destinations. Third, public input is used to identify what quality of bicycle facilities is actually expected by the public, and which new facilities are desired on what locations. Final decision-making is based upon benefit-cost ratios related to rankings from analyses, and public rankings. One of the outcomes of the latter was a ranking of improvement priorities; participants accorded most importance to development of on-road bicycle infrastructure, then off-road (trail-) infrastructure, then improvement of safety for cyclists. Efforts at establishing a modal shift towards cycling was considered the least pressing of the four goals (Alachua County MTPO, 2001a; Alachua County MTPO, 2001b; Alachua County MTPO, 2001c).

Although the Master Plan was later criticized for lack of focus on the integration of and connectivity between existing bicycle facilities and bicycle facilities to-be-constructed, it was recognized that it provides a solid, detailed analysis of infrastructure and thorough investigation of possible new lanes and path systems for Alachua County and Gainesville cycling infrastructure (Transporting Ecologies, 2004).

The aforementioned initiatives have led the City of Gainesville to have some of the highest levels of cycling activity in the state of Florida, and a strong reputation across the U.S. as being a bicycle-friendly community (Alachua County MTPO, 2001a, p28). The U.S. Census Bureau (2011) estimates the modal share for cycling in Gainesville to be around 3.3 percent in 2009, which places the city in the top ten metropolitan areas for number of commutes to work by bike in the U.S. Reports by the Alachua County Metropolitan Transportation Office and bicycle counts prove that campus of University of Florida accounts for an important share in overall bicycle commuting in Gainesville, and that a majority of trips by bike are done to and from, or around campus (Alachua County MTPO, 2009). The campus can thus be considered a key destination for commuters within Gainesville (Transporting Ecologies, 2004; Alachua County MTPO, 2001a, p17).

## **2.4 Bicycle commuting to and from University of Florida campus**

In relation to their surrounding environment, college campuses bear some unique characteristics. Balsas (2003) argues that they are very distinct communities, “places where people of different backgrounds, incomes, lifestyles and attitudes come together to live, study, work and recreate” (p36). This requires infrastructure needed to support large volumes of commuters, accommodating traffic flows, parking facilities and accessibility of the campus (Balsas, 2003, p36; Whalen, Paez et al, 2013, p133). In general, U.S. college campuses were conceived in the automobile era, where accommodation of cyclists and pedestrian traffic was rarely considered (Balsas, 2003).

One of the motives for establishment of the 2001 Bicycle Master Plan was the realization that “the existing bicycling conditions within Alachua County do not fully meet the needs of its residents or visitors” (P44) and that many of the major roadway corridors into the University of Florida campus currently lack bicycle facilities or operate considerably below the target standards of the plan (Alachua County MTPO, 2001, p29). Despite the fact that Gainesville has a high percentage of bike commuters for U.S. national standards, only a limited amount of commuting trips to campus are made by bicycle: 2010 traffic counts by the University of Florida revealed a modal share of 8% for cycling, while a survey investigating the commuting modes of off-campus residents to campus revealed a modal share for cycling of around 10% (University of Florida, 2010, p41). Thus, a



great share of potential bicycle commuters to UF campus is still using other modes of transportation than the bicycle, and it can be assumed that the full potential for commuting by bicycle to UF campus by staff, faculty and students is not being realized. This provides opportunity for further research on factors affecting the choice for bicycle commuting and the daily experience of bicycle commuters to UF campus in Gainesville. Research in this area might provide lessons for how to improve the modal share for commuting by bicycle to UF campus, and how to improve the cycling experience of this group of commuters. Since commuting to and from campus makes up an important part of overall commuting flows in Gainesville, this would ultimately concern the overall modal share for bicycle commuting in Gainesville.

## **2.5 Summary**

Concluding from the above, the bicycle has some considerable advantages over other modes of transport when commuting short to middle-long distances. Cycling is more environmental-friendly than motorized transport: no air or noise-pollution and less use of non-renewable resources. Cycling alleviates urban problems related to motorized transport: less use of space, resulting in less parking problems and less congestion. Also, cycling offers considerable advantages to health: the energy is provided for by the cyclist, which leads to regular daily exercise compulsory to a healthy life-style. Furthermore, and perhaps most important, commuting by bicycle might prove more convenient and faster than other modes of transport.

However, the choice to commute by bicycle is affected by many factors. As outlined above, despite the (successful) efforts to improve cycling conditions in Gainesville, commuting by bicycle still only represents a minor share of overall commuting to UF campus in Gainesville. It was pointed out that walking and using public transit can be considered environmental, societal and economic sustainable transportation modes. However, cycling offers the benefit over public transport to be a non-motorized transportation mode, and offers the benefit over walking that it is more convenient in bridging longer distances. Therefore, it is the modal shift from car to bicycle for purpose of commuting that is investigated in this research. It aims at investigating the factors that lead to the decision to commute to campus by bicycle or by car, and investigating the experience of people already commuting to campus by bike. The theory underpinning this research will be discussed in section 3.



## 3. Theory

### 3.1 Commuting mode choice

To understand how the modal share for commuting by bicycle can be improved, it is important to gather an understanding of how the decision for a commuting mode is made: what elements influence decision-making behavior? A model that is widely used to examine and explain behavior of different kinds is the Theory of Planned Behavior (Bamberg et al, 2010).

#### 3.1.1 The theory of planned behavior

The Theory of Planned behavior has been successfully been applied to predict and explain diverse behaviors. Heath and Gifford (2002) argue that it provides a “relatively parsimonious theoretical framework for integrating various key constructs and a clear operational definition of each construct within the theory” (p2155). The theory is the starting point for the extended version of the theory of planned behavior that will provide the basis for the survey conducted for answering two of the research-sub question: how do norms and attitudes towards bicycle commuting, and commuting behavior differ between car and bike users? First, I’ll shortly extend upon the Theory of Planned Behavior.

Ajzen (1991) states that general attitudes of a person, as well as general personality traits and behavior in specific situations, have proven weak predictors of specific behavior in previous research on intention and behavior. Rather, behavior in a specific situation is caused by an aggregate of general dispositions and other factors unique to a particular occasion, situation and observed action. This aggregate does not exclude general attitudes or personality traits of a person in leading to a certain behavior; rather, these impact elements that are more closely linked to behavior in question.

The Theory of Planned Behavior is illustrated in Figure 1. Central to the theory is an individual’s *intention* to perform a given behavior. Intention is the total of motivational factors that influence a certain behavior: indications of how hard people are willing to try, how much of an effort they are planning to exert in order to engage in a behavior. The stronger the intention, the more likely its performance in a certain behavior. In the original Theory of Planned Behavior by Ajzen (1991), intention is influenced by three kinds of beliefs: behavioral beliefs, normative beliefs and control beliefs.

- Behavioral beliefs – Attitude towards the behavior refers to the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question (Bamberg et al, 2010, p176).
- Normative beliefs - Subjective norm refers to the perceived social pressure to perform or not to perform behavior (Ajzen, 1991, p188).
- Control beliefs - People’s behavior is strongly influenced by their confidence in their ability to perform it: the perceived behavioral control. This concerns beliefs about the presence of factors that may further or hinder performance of the behavior (Bamberg et al, 2010). According to the Theory of Planned Behavior, perceived behavioral control, together with intention, can be used directly to predict behavioral control (Ajzen, 1991, p185).

Attitude, subjective norm and perceived behavioral control influence intention, which leads to a certain behavior. These basic elements of the Theory of Planned behavior are highly relevant when considering commuting mode choice: people have different attitudes and norms towards and perceived control over different commuting modes, which are predictors of the behavior of using a certain mode. In this section of research however, the ‘behavior’ is a given: respondents commute by car or by bicycle. Investigating how the norms, attitudes and perceived control

over bicycle commuting differ between car and bike users and result in the behavior of driving or cycling can provide leads on what should be subject to change in order to facilitate the decision to commute by bicycle.

The Theory of Planned Behavior has been applied in a variety of domains and received good empirical support (e.g. Ajzen, 2001; Armitage & Conner, 2001; Sutton, 1998). An example of the Theory of Planned Behavior applied to transportation research is provided by Bamberg et al (2010), who investigate the effects of an introduction of prepaid bus tickets on increased bus-use among college students. In the initial paper outlining the Theory of Planned Behavior however, Ajzen (1991) mentioned that the theory is open to expansion: the addition of other factors to the original model might improve prediction of behavior. An example of this is provided by Heath & Gifford (2002), who predict the use of public transportation among bus and car users using an extended Theory of Planned Behavior adding six variables. They conclude that “certain new variables, added in order to expand the original model, explain bus-use beyond that accounted for by the original TPB constructs” (p2175). The extended model will be outlined below.

### 3.1.2. The theory of planned behavior extended

In their article on the prediction of public transportation use, Heath & Gifford add three elements to the original TPB constructs (see table 1).

The theory of planned behavior extended
Attitude*
Subjective norm*
Perceived behavioral control*
Moral norm**
Descriptive norm**
Environmental values, awareness, and felt responsibility**

**Table 1 - The theory of planned behavior extended**

\* Original TPB elements

\*\* Added variables in extended model

Concluding their analysis on the prediction of bus use, they argue that all of them at certain stages in the comparative research had significant influence upon each other and the resulting behavior (choice to use the bus) (Heath & Gifford, 2002).

As mentioned above, the intention is not to predict the commuting behavior as a result of interplay of different elements. Rather, considering the behavior as a ‘given’ (commuting by car, commuting by bicycle), it is the intention to investigate how the elements that lead to this behavior differ for the two types of commuters: in short, what leads to the decision to commute by bike or by car? I consider the elements added in the extended TPB to be very valuable in explaining why populations choose to commute by bike and by car. Below, I will shortly extend on the meaning of each of the added elements.

The following elements are added in the extended model;

- *Moral norm* – This can be regarded as an individual’s perception of the moral correctness or incorrectness of performing a behavior, and take into account of “personal feelings of... responsibility to perform, or to refuse to perform, a certain behavior” (Ajzen 1991, p199).
- *Descriptive norm* – The perception of what most people do motivates individuals to do the same because it provides “evidence as to what will likely be effective and adaptive action” (Cialdini et al, 1990, p1015).

It differs from subjective norm in that it does not concern what friends and relatives ‘think’ of what you do or should do, but what friends and relatives actually ‘do’, and how this inherently influences your intention to perform certain behavior.

- *Environmental values, awareness and responsibility* – How is environment protection ranked among other values? Does caring for environmental protection make up for the decision to commute by bike? The same question will be investigated for environmental awareness and felt responsibility for environmental problems

Table 2 provides an overview of the elements of the extended TPB, and the value of considering them in this research and choosing the extended TPB over the ‘original’ TPB.

Elements of the extended TPB and their value in this research	
Attitude t/w behavior*	<i>What distinct benefits do car or bike commuting offer to their users? (convenience, costs, speed, comfort, etc) How are these valued by both groups, and are they valued differently?</i>
Subjective norm*	<i>To what extent do friends and relatives’ stances on commuting by bike influence the decision to commute by car or by bike? Does this differ for car and bike-users?</i>
Perceived behavioral control*	<i>To what extent do bike and car users feel able to come to campus by bike? Do they differ in terms of cycling experience, or do they value infrastructure differently? Does this differ for both groups?</i>
Moral norm**	<i>How do people feel about commuting by car or by bicycle? Do they feel bad or guilty when commuting by car? To what extent does this differ for car and bike-users?</i>
Descriptive norm**	<i>To what extent does the fact that friends and relatives commute by bike influence the decision to commute by car or by bike?</i>
Environmental values, problem awareness, felt responsibility**	<i>How do bike and car users rank environmental values among other values? Are they aware of environmental problems caused by car use? Do they feel responsible for environmental damage caused by car-use? To what extent do the groups’ answers differ for all three elements?</i>

**Table 2 - Elements of the extended theory of planned behavior**

\* Original TPB elements

\*\* Added variables in extended model

The extended Theory of Planned Behavior provides the structure for the survey that is conducted as first step in this research. The survey set-up will further be explained under the Methods section. The survey itself can be found under appendix 1. The conceptual model under 3.3 provides an overview of the research structure and the place of the survey and extended TPB within overall research.

### 3.2 Factors affecting bicycle commuting

While investigating norms and attitudes that shape the decision to come to campus by bike or by car in the previous section, the second section of research focuses upon the actual commute to campus by bike. The factors that have been found to influence the bicycle commute will be shortly extended on below.

According to Heinen et al (2010), little comprehensive research has been done on the dominant factors that influence commuting by bicycle. Since increased attention is paid to cycling as a component of

environmental, societal and economic sustainable transport policies, it is necessary to know the factors that shape commuting by bicycle: characteristics of bicycle use are very different from the characteristics of car and public transport use, and cycling for utilitarian purposes is likely to be influenced by different determinants than cycling for recreational purposes (Heinen et al, 2010, p60). Parkin et al argue that transport planning usually take costs and time as the main influences upon mode choice (2007a, p6). However, modeling cycling is more complex: cycling involves additional physical effort and exposition to weather conditions; furthermore, psychological factors such as self-image, perceived ability to cycle and social norms play a role (see section above), as do a wide range of other factors, e.g. levels of income, or availability of appropriate infrastructure (Heinen et al, 2010; Parkin et al, 2007a; 2007b, Rietveld & Daniel, 2004; Pikora et al, 2002).

Different attempts have been made at documenting the factors that influence the propensity to cycle in general, and commute by bicycle in particular. Pikora et al (2002) formulate a general framework that documents the physical-environmental determinants as well as individual factors that may influence both cycling and walking in the neighborhood. Physical-environmental factors are divided in functional factors (design and attributes of street, path, types of traffic, etc.), safety factors (crossings, lighting, surveillance) aesthetic factors (e.g. cleanliness and maintenance, sights) and destination (facilities, services, public transport, parking facilities, etc). On the other hand, the individual factors determining propensity to cycle or walk are made up by motivations, interest, social/family and support and health status (p1696). While the majority of these factors without doubt influence the propensity to cycle, it remains questionable whether all of these factors are as much relevant for the choice to commute by bicycle. A more in-depth model focused on bike-use solely is provided by Rietveld & Daniel (2004). The factors explaining bike use are divided in four categories: generalized costs of cycling (monetary cost, travel time, physical needs, risk of injury, risk of theft, comfort and personal security). Both the propensity of bike use and the generalized costs of cycling can be influenced by the second category: local authority initiatives and policy variables related to appropriate infrastructure design and pricing policies. These local authority initiatives also influence the third category of factors: generalized costs of other modes of transport, such as parking costs, tax on fuel, tolls, and supply of public transport services. The fourth section of factors is constituted by individual features (income, gender, age, activity) and socio-cultural background (image of cycling, cultural background, ethnic origin, political preferences) (p533). While the model by Rietveld & Daniel is more specific than Pikora's, both models do not take into account a number of other factors, such as topographical and climatic factors (Brandenburg et al, 2007; Nankervis, 1999; Parkin, 2003), urban land-use and mix of functions (Cervero, 1996; 2002; Kitamura, 1997); or nature of the vehicle and experienced comfort (Parkin, 2003; Xing et al, 2010). The most comprehensive overview of factors is offered by Heinen et al (2010). Their categorization of factors influencing the bicycle commute is outlined in table 3 below.

Factors affecting the bicycle commute (after Heinen et al, 2010)	
Built environment	<i>Urban form**, infrastructure***, bicycle facilities***</i>
Natural environment	<i>Hilliness and landscape, seasons, climate and weather**</i>
Socio-economic factors	<i>Socio-economic and household characteristics*</i>
Psychological factors	<i>Attitudes*, social norms*, habits*</i>
Costs	<i>Monetary costs*, travel time***, effort*, safety***</i>

**Table 3 - Factors affecting the bicycle commute**

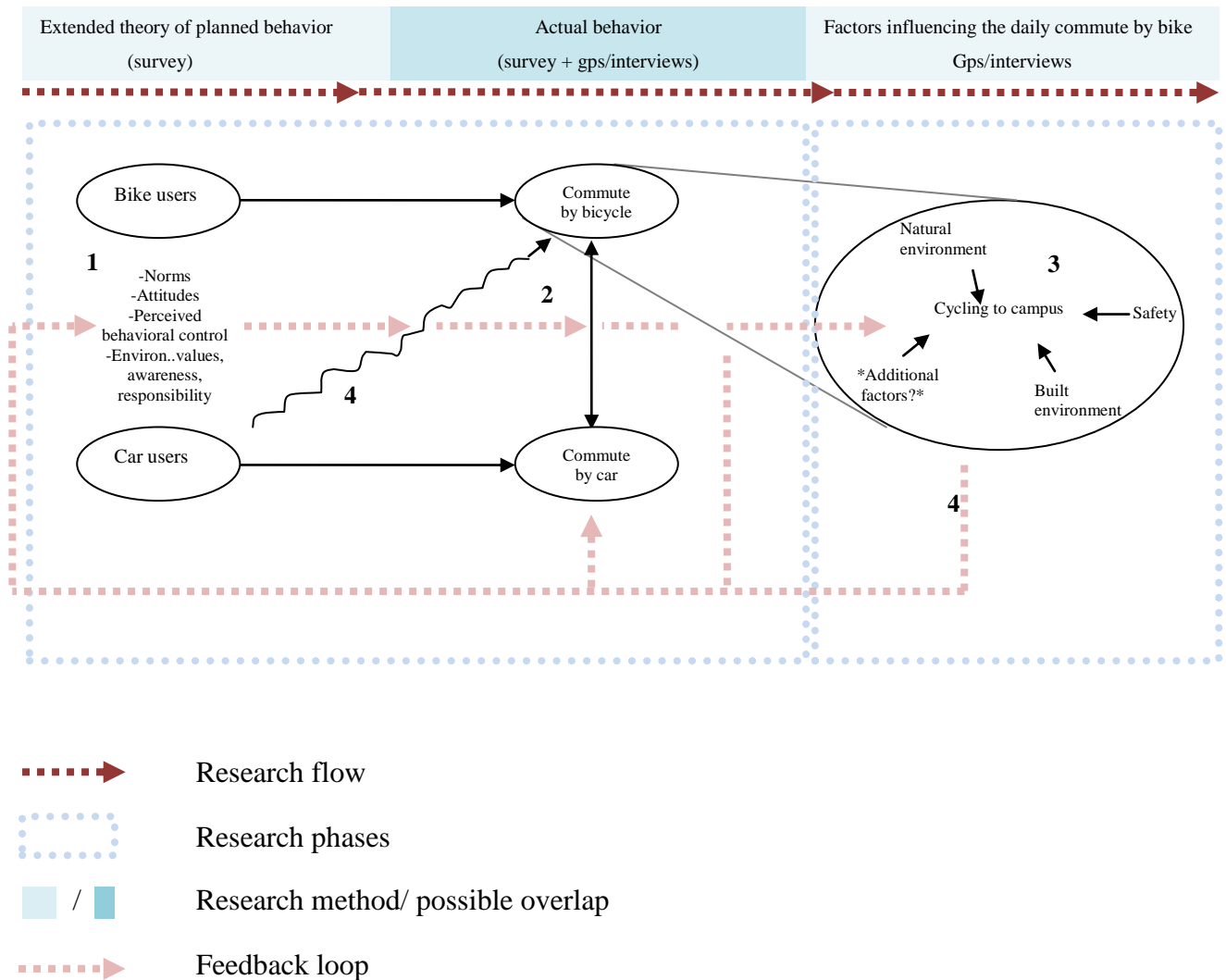
\* Factors dealt with in survey

\*\* Factors dealt with in gps/interviewing

\*\*\* Factors covered both in survey & gps/interviewing

As stated, a wide variety of factors have been found to influence commuting by bicycle. These factors however refer to both the a priori *decision to commute* by bicycle as well as the *actual* commute. The decision-making process that leads to commuting by bicycle is to a large extent covered by section 3.1 and the survey in the first section of research; for the second section of research, I will solely focus upon the factors that influence actual commuting to UF campus. Only some of the factors outlined in table 3 will be dealt with in that second section: built environment, natural environment, travel time and safety. The conceptual model and research questions will be detailed below.

### 3.3 Conceptual model



1. How do norms and attitudes towards bicycle commuting differ between car and bike users?
2. How does commuting behavior differ between car and bike users?
3. What factors influence cyclists' daily commute to UF campus?
4. What can be done to increase the attractiveness of commuting by bike and stimulate more people to commute by bicycle?

As mentioned, the aim of this research is to compare bike user norms and attitudes towards bicycle commuting, and assess the daily experience and behavior of bicycle commuters in order to propose changes to increase bike use. Research question 1 relates to the difference in norms and attitudes towards bike commuting between both bike and car commuters. It deals with how a decision for a commuting mode is made, and is investigated through the survey based upon the extended version of the theory of planned behavior (Heath & Gifford, 2002) Question 2 is about the actual behavior, and investigates how commuting behavior differs between car and bike users. This is partly investigated through the survey and partly through the GPS/interview section. Question 3 is about the factors influencing cyclists' daily commute to UF campus. Based upon Heinen (2010, see table 3), these factors will be researched through the GPS/interviews. Research question 4 is the synthesis of the three previous research questions, and is a try at fulfilling the research aim: what can be done to increase the attractiveness of commuting by bike and stimulate more people to commute by bicycle? In the conceptual model, this question relates to the visualized change in behavior for car users to start commuting by bike (4). It also relates to the feedback loop described, which is about making it easier for people already cycling to UF campus to keep cycling, and lower the bar to commute by bike for all commuters.

As can be seen in the conceptual model, the research process is divided into two phases that partly overlap. In the first phase, car and bike user norms and attitudes towards bike commuting are compared. In the second phase, the daily experience of bicycle commuters is assessed by researching the factors influencing their commute. For the two phases, different methods are used. The combined use of these methods has for purpose of fulfilling the research aim. The methods will further be described in section 4.



## 4. Methods

In this section, the research methods will be discussed. First, the methodology will be extended upon, and the choice for a mixed-methods approach will be explained. Under 4.2, the different methods will be described, including the survey, the origin-destination mapping-section in the survey, and the qualitative GIS approach. Under 4.3, the recruitment of participants will further be outlined, as well as the process of data collection. Under 4.4, the methods of data analysis will be described. Finally, philosophical and ethical considerations will be dealt with, including positionality of the researcher.

### 4.1 Methodology: a mixed-methods approach

In this research, a combination of different quantitative and qualitative research methods will be used. This methodology is variously called ‘multi method’ or ‘mixed method’ research (O’Cathain et al, 2007). Cope & Elwood (2009) make a distinction between multiple methods projects, in which different methods are practiced in parallel, and mixed methods projects, weaving together diverse research techniques “to fill gaps, add contexts, envision multiple truths, play different sources of data off each other, and provide a sense of both the general and the particular”.

This particular research project could be filed under both the multi-method and mixed-method categories. An argument for calling it ‘multi-method’ would be that the research consists of two phases, the first consisting of quantitative (survey) data collection, the second consisting of qualitative GIS data collection. An argument for labeling it as ‘mixed-methods’ would be that in turn, the qualitative GIS collection process itself unites a combination of qualitative (in-depth interviews) and quantitative (GIS) data collection. The logical option is thus to label the research as a ‘multi-method’, with one method containing a mixed-methods approach. However, O’Cathain et al (2007) argue that there is a move to standardize terminology and use the label ‘mixed methods research’ for studies combining qualitative and quantitative research. Driscoll et al (2007) state that the term ‘mixed methods research’ refers to all procedures collecting and analyzing both quantitative and qualitative data in the context of a single study. Furthermore, it can be argued that in this research, different qualitative and quantitative methods are used separately and jointly, but for purpose of weaving together the collected data for answering the research aim, and thus being mixed-method rather than multi-method research.

O’Cathain et al (2007) argue that in recent years, there has been increased interest in mixed-methods research in the fields of social and educational research. Both O’Cathain et al (2007) and Driscoll et al (2007) argue that this is driven by the pragmatic advantages when exploring complex research questions. “The use of mixed methods in research is driven by pragmatism rather than principle, motivated by the perceived deficit of quantitative methods alone to address the complexity of research (...)” (O’Cathain et al, 2007).

Cope and Elwood (2009) argue that mixed methods approaches are rooted in several specific assumptions about knowledge and epistemologies in research. First, mixed methods research tends to treat knowledge as always partial (no one can know the whole truth) and situated (dependent on researcher’s situation and positions). Second, mixed-methods research is premised on the notion that epistemology and methodology are related, but that this relationship is neither fixed nor singular. A certain epistemology need not prescribe a given methodological orientation or only one approach.

In their research on the use of mixed methods research, O’Cathain et al (2007) find that the purposes of these methods are primarily complementarity (methods used to address different aspects of the same question), expansion (methods used to address different questions) and development (one method used to inform the development of another).

The aim of this research is to compare bike user norms and attitudes towards bicycle commuting, and assess the daily experience and behavior of bicycle commuters in order to propose changes to increase bike use.

Two elements in the research (compare bike user norms and attitudes and assess the daily experience) constitute two research phases that partly overlap and finally serve the same research aim (propose change to increase bike use). Therefore, it can be argued that the use of mixed methods here is for purposes of complementarity (to address different aspects of the question of how to increase bike use) and expansion (used to address different questions). Below, I will further outline the individual methods and the choice for using these. Then, I will extend upon the recruitment of participants and the process of data collection. This will be followed by an explanation of the process of data analysis, and finally a reflection upon philosophical and ethical issues and positionality of the researcher.

## **4.2 Methods**

As discussed under the theory section, two methods are used in this research: a survey and a qualitative GIS (GIS/interviewing)-exercise. First, the choice for these methods will be explained. Then, the methods themselves will be extended upon.

### **4.2.1. Choice of methods**

As detailed above, this research makes use of a mixed methods approach. The first one is a survey, a quantitative data collection method. Quantitative research is used for purpose of quantifying a research problem, measuring and counting issues, and generalizing these findings to a broader population (Hennink et al, 2011). Parfitt (In: Flowerdew & Martin, 2005) and Steg et al (2013) state that surveys are an indispensable tool for collecting primary data on individuals' behaviours, attitudes, opinions and awareness of specific issues. The practical advantages of data collection through a survey are first of all the high external validity of the data, which means that results of the study can be generalized to other situations and to other people. Second, survey research is a cost-effective method for reaching and including large populations in research (Steg et al, 2013; Parfitt, 2005).

Weaknesses to survey research are the fact that manipulation of variables included in the survey is often hard, if not unethical or even impossible. Also, it is hard to include all variables relevant to the study of a phenomenon, determine relationships between the variables, and the direction (causality) of these relationships (Steg et al, 2013).

The second method used in this research is, as described above, a mixed-method in itself. The method is a combination of GPS/video-mapping and in-depth interviews, and can be labeled as a qualitative GIS methodology. Qualitative GIS is an expression that seems inherently contradictory: geographic information systems are generally being defined as "digital technologies for storing, managing, analyzing and representing geographic information" (Cope & Elwood, 2009). Geographic information systems process data models and offer structures for representing data, storing data and querying, retrieving, analyzing and mapping data. In other words, the main use of GIS was and still is considered to be the structuration and visualization of quantitative datasets. However, Jones and Evans (2012) state that "the last 15 years there have been a series of debates emerging out of critical GIS, feminist GIS and participatory GIS that have transformed the ways GIS is used as much as the increasing technological capability of the software" (p92). Simultaneously and increasingly, "GIS is understood as a collection of practices for producing and negotiating geographic knowledge through the representation and analysis of spatial data" (Cope & Elwood, 2009, p3), a movement beyond the quantitative processing of large datasets. The data processed in GIS might be qualitative due to the rich contextual detail they provide about social and material situations. Also, they might contain or provide interpretations of the situations or processes that they describe.

The strength of a mixed methods approach such as qualitative GIS employed in this research is thus the weaving together of diverse research techniques "to fill gaps, add contexts, envision multiple truths, play different sources of data off each other, and provide a sense of both the general and the particular" (Cope & Elwood, 2009, p5). For this particular research on bicycle commuting, it is the interpretation GPS data processed in a geographic

information system that together with video material and in-depth interviews that adds value to the research. The in-depth interviews offer the possibility to interpret the GPS data and video material by identifying the individual and personal experiences of the bicycle commute, beliefs, perceptions, motivations, feelings, etc. (Hennink et al, 2011).

The strength of combining both quantitative methods and qualitative methods is the possibility to identify and generalize issues at stake to a larger population, and nuance and/or enrich these findings through the individual experiences and findings from the qualitative data collection. Vice versa, the findings from the qualitative data collected can be linked to the broader issues identified with quantitative data. Below, both methods will be discussed. First, the survey questions together with the origin-destination mapping section. Second, the video-mapping exercise.

#### **4.4.2 Survey**

First, the structure of the survey will be discussed. The structure of the survey, including the elements from the extended theory of planned behavior as discussed in the theory section, and the questions, are visualized in boxes 1 – 6 below. As discussed, the survey used in this research is based upon the survey employed by Heath and Gifford (2002) in their research on bus ridership among college students. In this research, the survey is used to research the factors that influence the decision to commute to University of Florida campus by bike or by car. A comparative analysis of the elements that shape the actual behavior could provide leads on proposing (practical or policy-related) changes to increase bike use. The structure and elements of the Heath & Gifford survey remain unchanged, as the elements potentially provide very useful insights in explaining behavior (commuting by bike vs. commuting by car). Some questions have been modified for adaptation to the research topic. These modifications will be clarified below. The survey conducted online can be found in appendix 1. It will be discussed section for section below, for each of the constructs of the extended theory of planned behavior as outlined under the theory-section.

##### **4.4.2a Survey structure**

The survey starts out with a block of introductory questions, collecting general information (see box 1). These questions are easy, as a ‘warm up’ exercise for the participant (Parfitt, 2005). Age, gender and position at UF are inquired, as well as the general recreational physical activity performed by the participant (possibly limited by physical impairment). This is followed by question 6, where participants are asked to estimate the distance between home and destination on University of Florida campus. This will be analyzed in combination with the results from the origin-destination mapping section, discussed below. Question 7 investigates commuting mode: this will divide the total of responses in the groups of bike user respondents and car user respondents for the data analysis. Since car commuters might occasionally commute to campus by bike and vice versa, participants are asked which mode of transportation they use most of the time when commuting to and from campus, the average number of days a week they commute using this mode, and what other modes they use when not coming to campus by bike or car respectively. Following the general information section is the section of questions investigating commuter attitudes towards bike and car commuting (box 2). Question 10 is about the evaluation of behavioral beliefs: respondents are first asked to evaluate how important each of the aspects (convenience, speed, comfort, cost and time-control) are to them when choosing a transportation mode to and from campus. They are then asked to evaluate the probability that these factors are true for them for the next time they commute to campus by both car or bike (question 11 & 12). Question 13 and 14 close the attitudes section, and investigates the actual attitude of participants towards commuting to campus by car and bike.

Following attitudes, the participants’ subjective norms are investigated. To what extent would people important to them support or think that they should use a bike to commute to and from campus? (Box 3)

Following subjective norm, perceived behavioral control of participants is investigated (box 4). First, perceived behavioral control is investigated through the question “how difficult is it for you to bike to campus?” Participants

are the asked to evaluate control beliefs by assessing four factors that would or not facilitate their decision to commute to campus by bike: sufficient bike lanes, good quality bike lanes, sufficient bike parking on destination and sufficient cycling experience and skills. For subjective probability of control beliefs, participants are asked how likely it is that these factors are sufficient in their specific situation.

Box 1 - General information

1. Age
2. Gender
3. Position at UF
4. Any form of physical activity
5. Please indicate the number of times you practiced physical activities in the last 12 months
  - Walking for pleasure
  - Cycling for pleasure
  - Sports
6. What is the distance between home and your destination on University of Florida?
7. Which mode of transportation do you use most of the time when commuting to and from UF campus?
8. On average, how many days a week do you commute to UF campus using this mode?
9. When using other transport modes, how do you travel to campus?

Box 2 – Attitudes

*Evaluation of behavioural beliefs*

10. How important are each of the following aspects to you when choosing a commuting mode to UF?
- Aspects: *convenience, speed, comfort, cost, time control*
  - Scale: *very important -2 – very unimportant +2*

*Subjective probability of behavioural beliefs*

11. If I drive to campus with a car, it is very..
- Factors: *convenient, quick, comfortable, cheap, offers good time control*
  - Scale: *strongly agree -2 – strongly disagree +2*
12. If I cycle to campus , it is very
- Factors: *convenient, quick, comfortable, cheap, offers good time control*
  - Scale: *strongly agree -2 – strongly disagree +2*

*Attitudes towards cycle/car commuting*

13. I don't like the idea of cycling to campus
14. I don't like the idea of driving to campus
- Scale: *strongly agree -2 – strongly disagree +2*

Box 3 – Subjective norm

15. People important to me would support me in biking to commute to and from campus
16. People important to me think that I should use a bike to commute to and from campus
- Scale: *strongly agree -2 – strongly disagree +2*

Box 5 represents the questions for the moral and descriptive norms. To what extent do participants feel guilty or bad when using the car to commute to campus? For the descriptive norm, participants are asked to indicate how many friends or colleagues in their surrounding commute to UF by bike. This section is followed by the 'Environment' section of the survey, where participants are asked to rank values, answer questions on problem awareness and on felt responsibility. For the environmental value rank, participants are asked to rank seven values, in order to investigate how high they rate environmental protection amongst other values. This section is followed by a car-use problem-awareness section, and a section investigating participants' felt responsibility for problems caused by car commuting. Closing the survey, a map has been included where participants are asked to indicate their origin (home) and destination (work on campus) when commuting to UF campus. This will further be extended below.

#### Box 4 – Perceived behavioural control

##### *Perceived behavioural control*

17. How difficult is it for you to bike to campus?

##### *Evaluation of control beliefs*

18. How much would the following factors facilitate your decision to commute to campus by bike?

- Factors: *sufficient bike lanes on itinerary, good quality bike lanes on itinerary, sufficient bike parking on destination, sufficient cycling experience and skills*
- Scale: *not at all facilitating -2 – very facilitating +2*

19. What else would facilitate your decision to take the bicycle to commute to and from campus?

- *<open question>*

##### *Subjective probability of control beliefs*

20. The next time that you cycle to campus, how likely is it that the following is true for you?

- Statements: *there are sufficient bike lanes on my itinerary, there are good quality bike lanes on my itinerary, there's sufficient bike parking on my destination, I have sufficient cycling experience/skill*
- Scale: *very unlikely -2 – very likely +2*

#### Box 5 – Moral norm, descriptive norm

##### *Moral norm*

21. I feel guilty about it when I drive to campus by car

22. I do not feel bad about it when I drive to campus by car

- Scale: *strongly agree -2 – strongly disagree +2*

##### *Descriptive norm*

23. How many of your friends/colleagues use a bike to commute to/ from campus?

#### **4.4.2b Origin destination mapping**

Closing the survey, an origin-destination-mapping section has been included. The purpose of this map is to have participants indicate their origin (home) and destination on campus when commuting to University of Florida campus by bike or by car. The goal is to gain an overview of spatial patterns of origins and destinations of bike and car commuters. A dot-map showing where participants come from when commuting to campus has the potential to reveal information on average distances they travel to campus. This information could be useful in answering a

multitude of questions: do car-commuters on average live further away from campus than bike-commuters, or is that not the case? Does the concentration of bike commuters in a certain area coincide with well-developed bike infrastructure? And vice versa, does a concentration of car-commuters in a certain area mean that the bike infrastructure is under-developed or lacking? The resulting map is shown in figure 1.

#### Box 6 – Environment

##### *Value rank*

24. Seven different values are listed below. Which of them are most and least important to you?

- Values: *social power, true friendship, quality of life, material wealth, protecting the environment, authority, family security*

- Rank: Most important, 1 – least important, 7

##### *Problem awareness*

25. Car use causes serious air pollution in the world

26. Car use is a major source of noise problems in the world

27. Car use contributes to the depletion of energy resources

28. In Gainesville, air pollution caused by car use is getting serious

29. In Gainesville, car use is a major source of noise problems

30. Traffic jams are a problem in Gainesville

31. Finding a parking spot is a problem in Gainesville

32. Many neighbourhoods in Gainesville are unsafe because there is too much traffic

##### *Felt responsibility*

33. I personally feel responsible for the problems resulting from car use when I drive

- Rank: strongly agree -2 – strongly disagree +2

For the creation of the map, GIS data was retrieved online and processed in ArcGIS. The free GIS data was downloaded in the Metadata Explorer, the website of the Florida Geographic Data Library distributing spatial GIS data throughout the state of Florida. A variety of datasets was downloaded from the library, of which four finally constituted the basis for the origin-destinations map in the survey: a major roads dataset, Florida colleges and universities dataset, a cities and towns of Florida dataset, and finally a generalized land-use dataset, with land uses specified for parcels.

As the map would be used in a survey filled out by a wide variety of participants, both online and on paper, in color and black and white, it was the aim to keep it as simple and clear as possible. The map was built in ArcMap. The map was then exported in a PDF file format and inserted into the online Qualtrics survey.

#### **4.4.2c Video mapping**

As explained earlier, the video mapping exercise itself is a mixed-method data collection process consisting of three elements: have participants video-tape their commute, GPS-log participants' commute and conduct follow-up in-depth interviews. The strength of conducting research using mixed-methods is that weaving together techniques can help fill gaps, add context, envision multiple truths, play different sources of data off each other and provide a sense of both the general and the particular when collecting data (Cope & Elwood, 2009). Having participants tape their commute and logging GPS data help the researcher to visualize the participants' commute as if he was there himself, but without intervening in person. Follow-up in-depth interviews allow the researcher to add context to the video and GPS data, can fill up gaps in knowledge, and help obtain a richer knowledge base through a combination of video, GPS and spoken word.

For the video mapping exercise, two different documents were created: the GPS camera user guide (appendix 4) and the GPS camera interview guide (appendix 5). The user guide was handed to the participants prior to taping commute, and contains four elements: the informed consent form (see section 4.5.1), a short introduction to research, instructions on how to use the camera, and a section with ‘things to consider before video mapping your commute’. In this last section, participants were asked to critically reflect upon some aspects of their commute, on which they would be interrogated later on during the in-depth interview. As detailed under the theory section, the intention is to research specific elements in this section: factors influencing the commute by bike, such as built environment (urban form, infrastructure and bicycle facilities), natural environment (landscape features, seasons, climate and weather), and so-called ‘costs’ issues (travel time, safety). For a clarification, see table 3 in section 3.2 based on Heinen et al (2010).

Participants were thus asked to think about these elements prior to and during their commute, in order to gain possible observations and thoughts to cover during follow-up interviews. The second document created for the GPS interview sessions was the interview guide. This document was created to structure the interview. According to Hennink et al (2011) the structure of the interview guide should consist of an introduction, opening questions, key questions and closing questions (see box 7). Furthermore, questions should be open, short and simple, and include only one question at a time.

Questions were formulated to fit these requirements as much as possible. Also, topical probes were included in the interview guide. As Hennink et al (2011) state, “topical probes are essential for designing in-depth interview questions. The open style of questioning allows the interviewee to respond by telling their own story or experience, and the probes that follow remind the interviewer to ask about specific topics to ensure that detailed information is collected on all issues of interest. Box 8 is an excerpt of the interview guide included in appendix 11, and shows an example of a section of the guide, with the questions and topical probes used.

#### Box 7 – Structure of the interview guide

- *Introduction*
- *Background information*
- *Opening questions*
- *Questions on commuting route taped*
- *Questions on urban form*
- *Questions on mixed traffic*
- *Questions on safety*
- *Closing questions*

#### Box 8 – Example of interview section

##### *Questions on urban form*

When no bike infrastructure available (cycle paths, lanes or trails)

1. How do you cope with missing infrastructure?

*Probe: ride on-street? Ride off-street?*

2. Does this have implications for safety? Convenience? Comfort? Speed?

*Probes: is it less safe/convenient/comfortable/fast? Do you mix with other transport modes?*



Figure 1 – Origin destination map in survey

### 4.3 Respondents and data collection

The survey was constructed using Qualtrics software. Although the initial idea was to have the survey conducted online solely, a PDF version was prepared in case surveying in the streets would be considered necessary. The survey was prepared in January and February 2014, launched on March 17th and closed on the 25th of May. The sampling technique used was that of snowball sampling. This was started by asking acquaintances relevant to the research to fill out the survey, and requesting them to come up with other potential participants who would be willing to fill out the survey. At the end of the survey, bike commuters were asked if they would be willing to



participate in further research, that is, the GPS interview section. Thus, participants in the second section of research were collected through the survey.

Three major issues were at stake when conducting research at University of Florida. First of all, the researcher was new to his research area, thus it was expected that collecting respondents for an online survey would be harder. Second, one of the sampling groups targeted is the bike commuters to University of Florida campus. Since this is a relatively small group of people, it was expected that it would be challenging to collect a reasonable number of surveys. The strategy of convenience (snowball-) sampling was used, which will be discussed in section 6. Third, different from the researcher's home institution, conducting research methods at UF required specific approval from the University of Florida Institutional Review Board.

Reflecting upon the research process, the two former issues worked out fairly well, whilst the latter one proved an obstruction to the research process. With 112 filled-out questionnaires returned, the snowball sampling method worked well. Ruling out surveys with missing values, 89 surveys prove useful, of which 66 are responses by bicycle commuters. Thus, the response rate proves to be higher among bicycle commuters than car commuters, although this group is larger than the group of bicycle commuters. It is probable that this is caused by the fact that bicycle commuters are more motivated to fill-out a survey that serves the purpose of researching how the modal share for bicycle commuting can be increased, and thus serves their 'cause'. Also, snowball sampling leads respondents to ask people familiar to them to fill out the survey. It is likely these people perform the same behaviour. The third issue, approval of research methods by the Institutional Review Board, will be discussed in detail below. Research methods were approved, but this slowed down the research process as a whole, leaving less time to collect participants for the second phase of research.

## **4.4 Methods of data analysis**

### **4.4.1 Survey**

The survey has for aim to compare car and bike user norms and attitudes towards bicycle commuting. Thus, an analytical tool has to be chosen to make sense out of the data collected and explore the significance of results. The goal of these analyses is to test whether differences in norms and attitudes toward bike commuting between car and bike users prove significant.

Analyses are performed in the SPSS Statistics computer program. Building on the example of the Heath & Gifford (2003) survey, questions in the survey are formatted on a 5-point Likert scale, from -2 to +2 (generally 'strongly disagree' to 'strongly agree'). Main tool of analysis is the Independent Samples T-test, which determines whether there is a statistically significant difference between the means in two unrelated groups. The null hypothesis for the independent t-test is that the population means from the two unrelated groups are equal. For this research, it is interesting to see if the Independent Samples T-sets can reject the null hypothesis, in order to accept the alternative hypothesis that population means are not equal. To do this, the differences in population means are tested against a significance level (P) of 0.05. Under the results section, P levels of <0.05, <0.01 and <0.005 are used to show varying degrees of significance.

Furthermore, for two groups of related questions, multiple linear regressions are performed. A Multiple linear regression determines the relationship between independent variables and a dependent variable. The dependent variable can be predicted based on the value of the independent variables (Norusis, 2008). An example of a question in the survey is "How difficult is it for you to bike to campus?" Using multiple linear regressions, it can be assessed to what extent the level of difficulty is predicted by "Sufficient bike lanes", or "Sufficient cycling experience and skills". "Difficulty" is then the dependent variable, "bike lanes" and "experience and skills" are the independent variables. The extent to which the regression model predicts the outcome significantly well is shown by the P value, which again has to be <0.05 to be significant.

Before analyzing the data using SPSS, the data have to be prepared for use. To do this, data were exported from Qualtrics and imported in SPSS. The filled-out surveys containing missing values were filtered out, and data were separated into two groups based on the answer (bike/car) to the question “How do you mostly commute to University of Florida campus”. Then, data were ready for analysis using Independent Samples T-test and multiple regressions. Results are shown in 5, the results section.

#### 4.4.2 GPS - interviews

The GPS interview section of the research has for aim to investigate the factors that influence the daily bicycle commute to University of Florida campus. Using Heinen et al (2010), different factors were identified that are relevant to commuting by bicycle, to be covered in the GPS interview sections (see table 3,). Data analysis in this section of research is about connecting three data sources: GPS data, video imagery and interviews.

GPS data are collected through the Contour GPS camera, which offers the possibility to register GPS data and video simultaneously. Visualizing the video is done by using Contour Storyteller software; this software permits the visualization of video together with the GPS location data, biking speed, elevation and total trip time. For purpose of this research, GPS data are exported in a GPX-format using Contour Storyteller. The data are then imported in ArcMap and visualized on a base map background layer.

For analysis of the interviews, the principles and process of developing grounded theory are used. Hennink et al (2011) describe grounded theory as “a process for developing empirical theory from qualitative research that consists of a set of tasks and underlying principles” (p208). The analytic tasks of developing grounded theory follow a fixed order;

<b>Grounded theory</b>	
<b>1</b>	Preparation of verbatim transcripts
<b>2</b>	Anonymize data
<b>3</b>	Develop codes
<b>4</b>	Define codes in a codebook
<b>5</b>	Code data
<b>6</b>	Describe
<b>7</b>	Compare
<b>8</b>	Categorize
<b>9</b>	Conceptualize
<b>10</b>	Develop theory

**Table 4 - The process of grounded theory (Hennink et al, 2011, p209)**

One of the characteristics of grounded theory is that “analytic concepts are constructed inductively from data, not from deductive theories” (Hennink et al, 2011). However, it is acknowledged that building theory is an ongoing exchange between existing theory and new insights. This is especially relevant to this research: the factors researched and the themes for the interviews were identified from existing literature. Thus, insights from the interviews will be discussed in relation to the existing body of literature on these factors.

For data preparation, verbatim transcripts were made of the interviews held (see appendix 11). After making the transcripts, the data was anonymized, in order to remove any identifiers from the transcript to preserve the participant’s anonymity. Codes were developed, categorized and organized in a code book (appendix 12). Data were then described, categorized and compared with existing literature. Also, for the relevant sections, video stills including GPS location and speed data are included. Results are discussed in section 5.

## **4.5 Ethics and positionality**

### **4.5.1. Informed consent and the institutional review board**

As stated above, both research methods had to be approved by the Institutional Review Board at the University of Florida prior to their execution. As stated on the Institutional Review Board (IRB) website, “IRBs review ALL research involving human subject to ensure that their welfare and rights are protected as mandated by federal regulations. You may not conduct any human research without prior IRB approval”. For this particular research, methods were submitted to the ‘Behavioral/NonMedical’ IRB-02 office, reviewing research studies that involve “behavioral observations/recordings, non-invasive physiological recordings, analysis of documents that were previously gathered for non-research purposes, evaluation of behavioral/social interventions or manipulations, educational assessments, interviews, surveys, cognitive tests and taste/food evaluation” (University of Florida, 2014).

For each of the methods, two documents had to be submitted to the IRB office: first a Protocol for Review had to be prepared, stating title of the project, principle investigator, supervisor, dates of proposed research, source of funding, scientific purpose of the investigation, a description of the methodology, and the potential benefits and anticipated risks to the participants, amongst others. The protocols for review are included in the Appendix (Protocol for Review of survey in appendix 2, Protocol for Review of video-mapping exercise in Appendix 6). Second, the respective methods had to be submitted in printed form, including an informed consent form formulated along the IRB guidelines. The guidelines require an informed consent form formulated as a letter directed at the research participant, including description of the research, research method, of the participant’s rights as a research subject, etc. Participants are required to sign the form in order to validate their participation and use of results in research. The IRB approval forms for both research methods are included in appendix 3 (survey) and 7 (video-mapping).

### **4.5.2 Philosophical and ethical issues**

As explained previously, a mixed methods approach is used in this research. This partly has its origin in the philosophical underpinnings of this research. The methodological approach to this research is largely rooted in the field and movement termed as behavioral research in geography. According to Golledge (2011) “behavioral geographers evinced an interest in seeking process explanations for why specific spatial actions were undertaken” (In: Aitken & Valentine, 2011, p75). According to him, behavioral geographers focus more upon the explanation of a spatial process or action formed by perceptions, attitudes, learning processes, etc., rather than the form of this spatial behavior. One of the questions asked by behavioral geographers is what relationship exists between a certain reality and the world constructed inside our heads. In the specific case of this research, it is the perception of ‘outside world’ that leads to a certain commuting behavior by UF students, staff and faculty. The first section of research explains how different groups of commuters come to a certain behavior through investigating differing norms, attitudes, control factors, and perceptions, on behalf of which they act. The second section focuses more upon how bike commuting itself is influenced by external factors (built environment, infrastructure, climatic conditions), but with the goal of translating this into action points, aimed at mitigating or changing these factors for the benefit of the spatial process commuting by bike. The aims and objectives of this research are thus shaped by strong normative beliefs concerning the ‘emancipation’ of a travel mode, the right to modal choice, the right to commute by bike safely and comfortably, and what is perceived to be the good practice of traveling and commuting in an environmental friendly way.

This normative framework of the project is shaped by the positionality of the researcher, and is extra important in considering ethical matters, especially for the fact that research is conducted in a foreign context. Coming from the Netherlands, the researcher finds himself in a foreign context. In The Netherlands, the bicycle was the main mode of transport before the introduction of the automobile, and it still is a major transport mode in cities today. Throughout the 20<sup>th</sup> century, planning policies issued by the national government were aimed at

concentrating urban growth and mitigating urban sprawl. It has led to a specific conception of traveling and transportation: high degrees of urbanization led to well developed public transit systems with high ridership rates, and the bike as a fully developed transport mode alongside bus, train and automobile. As such, the broadness and the self-evidence of mode choice is a given in the Dutch context, and this context has strongly shaped researcher's views. The project is thus largely shaped by the normative framework that was defined by the Dutch context in which the researcher lives and works, and in which the project was conceived. The transferability of this normative framework to a foreign context, in this case the United States, is something that has to be considered. A different research context, a different society, brings along different views on what is good and what should be. Research on increasing levels of bicycle commuting might be less legitimate for U.S. citizens than it is for the Dutch, as mode choice is less self evident, of less relevance and less important to many in the American society.

Different views and thus positionality are not only apparent between different societies or contexts, but also within the same society. An example comes from one of the interviewees in this research project. The interviewee, a cycling enthusiast and strong supporter of sustainable mobility herself, explains how she encountered radical different views while taking part in discussions organized by transportation boards:

*“There are still people that believe we need to add other lanes so we don’t have congestion, instead of rethinking land-use, mass transit, cycling, (..) you know, think in more options to make it multimodal (..). People on that committee were like, ‘oh no, we need to make four-lane roads, cause we have a traffic problem’. I said, we have traffic problems because we don’t have density and enough modal choice”.*

These observations confirm that being aware of the own normative framework and positionality in terms of what is considered self evident and what is not, is key in conducting research that is legitimate and meaningful to a larger group of people. It underlines that research on bicycle commuting might not be meaningful to a lot of people if the broader worldviews in which this research is rooted aren't laid out correctly. Working on improving cycling conditions and giving the cyclist a full, fixed spot among other traffic modes, might not be meaningful and important to a lot of people, if researchers fail to explain why they think this should happen and what views legitimize their work. In this case, the actual research and data collection has to be firmly rooted in a theoretical framework that serves the purpose of providing the research with a foundation and legitimacy. This is even more important now that the research is conducted in a context that is new to the researcher.

## 5. Results

### 5.1 Survey

As stated earlier, a total of 89 complete surveys were collected through the online surveying utility Qualtrics. The survey with results can be found in appendix 8. As mentioned under 4.4.1, two statistical tests were used for analysis: Independent Samples T-tests for all questions, and multiple regressions for two groups of related questions. The structure of the survey was outlined under 4.4.2a. Box 9 shows the structure of the survey as it will be discussed below. The origin-destination mapping section of the survey is the last element, and will be discussed separately as these results are processed in ArcMap instead of SPSS.

Box 9 – Structure of survey as discussed in the results section

#### 5.1.1 General information (respondent characteristics)

#### 5.1.2 Attitudes

- Evaluation of behavioural beliefs
- Subjective probability of behavioural beliefs
- Attitudes towards bike/car commuting

#### 5.1.3 Subjective norm

#### 5.1.4 Perceived behavioural control

- Perceived behavioural control
- Evaluation of control beliefs
- Subjective probability of control beliefs

#### 5.1.5 Moral & Descriptive norm

- Moral norm
- Descriptive norm

#### 5.1.6 Environment

- Value rank
- Problem awareness
- Felt responsibility

#### 5.2 Origin destination mapping

#### 5.1.1 Respondent characteristics

There is no significant difference in average age between car commuters ( $M = 30.48$   $SD = 10.8$ ) and bike commuters ( $M = 30.75$ ,  $SD = 12.03$ ) respondents. The age distribution of the total of respondents is visualized in figure 2. For both commuter group samples, the majority of respondents are male: 62% for the car commuters and 52% for the cyclists. 64% of the respondents are students, while the rest indicated to be staff (23%), faculty (7%) or have an 'other' position (5%, administrator or teaching assistant). This relates to the high number of respondents who fall in the younger categories of the age distribution.

Respondents were asked to indicate the number of times they practiced certain types of physical activities in the last 12 months, such as walking for pleasure, cycling for pleasure or sports in general. Figure 3 provides an overview. Results show that the respondents commuting by bike tend to do significantly more cycling in their free time than car commuters do ( $P < 0.005$ ). Bike commuters on average walk slightly more often than car commuters, but car commuters tend to practice sports more often. None of these differences are significant.

Respondents were asked to estimate the distance between home and their destination on University of Florida campus. Results show that there is a significant difference in estimated distances ( $P < 0.005$ ): car commuters on average travel an estimated 4.57 miles ( $SD = 30.4$ ), while cyclists travel an estimated average of 2.67 miles ( $SD = 26.3$ ). This may indicate that car commuters tend to live further away from their job, which might be a reason or justification for their choice to commute by car. However, estimations might be a matter of

perception. This will further be investigated in the origin-destination mapping section under 5.2, where actual distances of commuters are visualized.

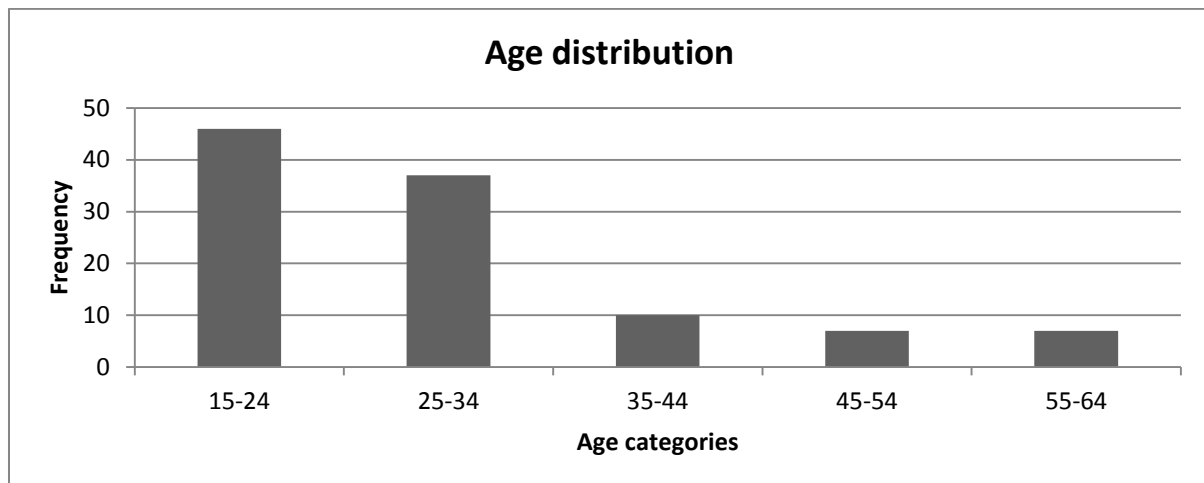


Figure 2 - Age distribution of survey respondents

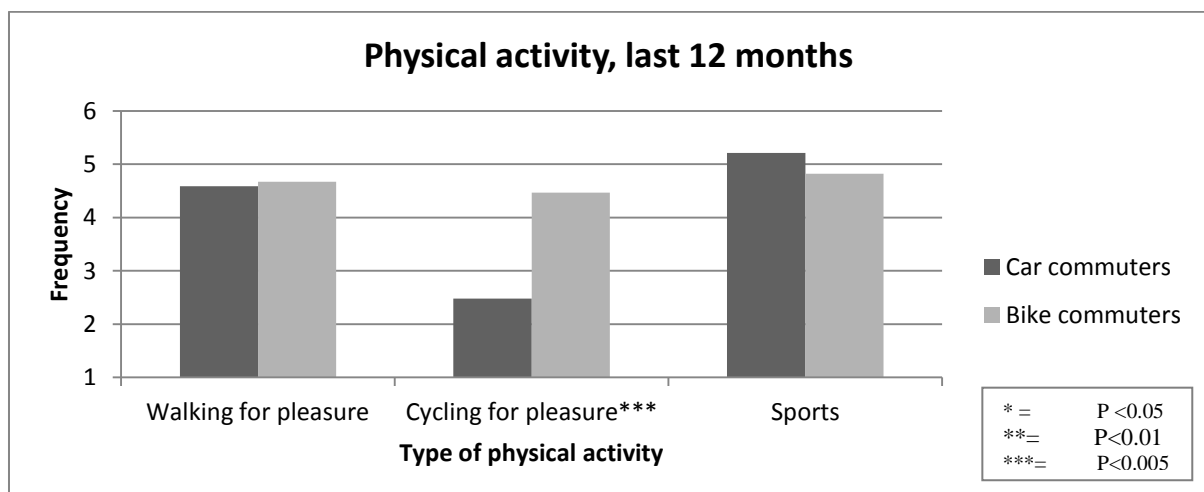


Figure 3 - "Please indicate the number of times you practiced physical activities in the last 12 months (1=none, 2=less than once a month, 3= once a month, 4 = less than once a week, 5 = once a week, 6 = more than once a week)

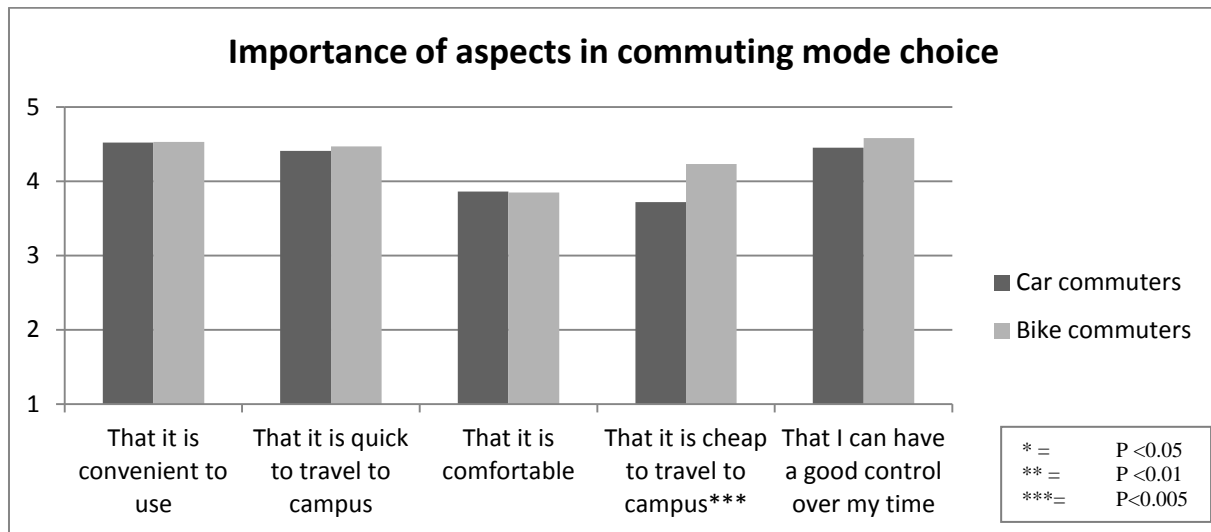
The last question in the general section, respondents were asked how many days a week they commute to UF using their particular mode of transport (bike or car). No significant difference is found here. Car commuters come to campus by car on an average of 4.31 days a week while cyclists come by bike on average 4.24 days a week. For both groups, the bus is the most used alternative (43%).

Below, I will discuss the results for each of the elements of the extended theory of planned behavior, beginning with attitudes.

### 5.1.2 Attitudes

First, participants were asked to evaluate their behavioral beliefs regarding commuting in general. They were asked to reflect upon five elements that play a role in choosing a transportation mode when commuting: convenience, speed, comfort, cost and time-control. Figure 4 provides an overview of the responses to the question. Both car and bike commuters estimate convenience, speed and time control to be important to extremely important. Comfort was rated important, but less important than these three factors. The cost of a transportation mode is significantly more important to bike commuters than to car commuters in their choice for

a certain transport mode ( $P < 0.005$ ). The low costs are thus most important in explaining why commuters decide to ride by bike rather than by car.



**Figure 4 – “How important is each of the following aspects to you when choosing a transportation mode to and from campus?” (1=completely unimportant, 2=unimportant, 3=neutral, 4=important, 5=extremely important).**

After reflecting upon these five elements in general, participants were asked to reflect upon the probability of these factors in relation to driving to campus (figure 5) and cycling to campus (figure 6): how probable is it that the factors true for them or not, if they intend to use these modes to come to campus. Results show that both groups of commuters are significantly more positive about their own commuting mode than about the other for all factors researched. Car commuters agree with the statements that driving to campus is convenient ( $M = 4,21$ ), relatively quick ( $M = 4,28$ ) and comfortable ( $M = 4,48$ ) and offers good control over time ( $M = 4,45$ ). Asked if they think that commuting by car is relatively cheap, their stance is neutral ( $M = 3$ ). Bike commuters are significantly less positive about coming to campus by car on all aspects. They disagree with the proposition that commuting by car is convenient ( $M = 2,23$ ) and cheap ( $M = 2,1$ ), but they are less negative for the propositions that it is relatively quick ( $M = 2,93$ ) and offers good control over time ( $M = 2,65$ ). Bike commuters are unanimously positive about commuting by bike, with high levels of agreement for the statements that commuting by bike is convenient ( $M = 4,57$ ), quick ( $M = 4,28$ ), and cheap ( $M = 4,8$ ) and offers good control over time ( $M = 4,65$ ). While they least positive towards the statement that commuting by bike is comfortable ( $M = 3,87$ ), this seems to be the point car commuters disagree with most ( $M = 2.59$ ). Car commuters furthermore doubt that cycling is convenient and relatively quick, while they are positive that it offers good control over time ( $M = 3,55$ ) and agree more strongly that it is relatively cheap ( $M = 4,38$ ).

Thus, the motivations for cyclists to choose the bike over the car reflect their general statements about factors important when choosing a commuting mode: they value convenience, speed, cost and time control when choosing a transport mode, and seem to find that the bike offers all of these. While they are less positive about the comfort the bike offers (Figure 5), this matches their expectations of commuting mode (Figure 3). Car commuters are in general less concerned with the cost of a commuting mode than are cyclists (Figure 3). However, they value convenience, speed, comfort and time control. Figure 5 shows that they doubt the convenience, speed and comfort offered when commuting by bike, while agreeing that it is relatively cheap, and being more neutral towards time control.

A part from these five factors deemed important when choosing a commuting mode, participants were asked to what extent they actually like or dislike the idea of driving or cycling to campus. Statements are “I don’t

like the idea of cycling to campus” and “I don’t like the idea of driving to campus”. Possible answers range from 1 (strongly disagree) to 5 (strongly agree). Both bike ( $M = 1,33$ ) and car commuters ( $M = 2,34$ ) on average disagree with the statements that they don’t like the idea of cycling to campus. Cyclists disagree significantly more than automobilist ( $P < 0.005$ ). Asked if they dislike the idea of driving to campus, cyclists on average agree with the statement ( $M = 4,12$ ) whereas the automobilist are divided between a neutral and disagree ( $M = 2,66$ ). Yet again, this difference in opinion is significant ( $P < 0.005$ ). Thus, car commuters are less negative towards cycling than they are towards driving to campus.

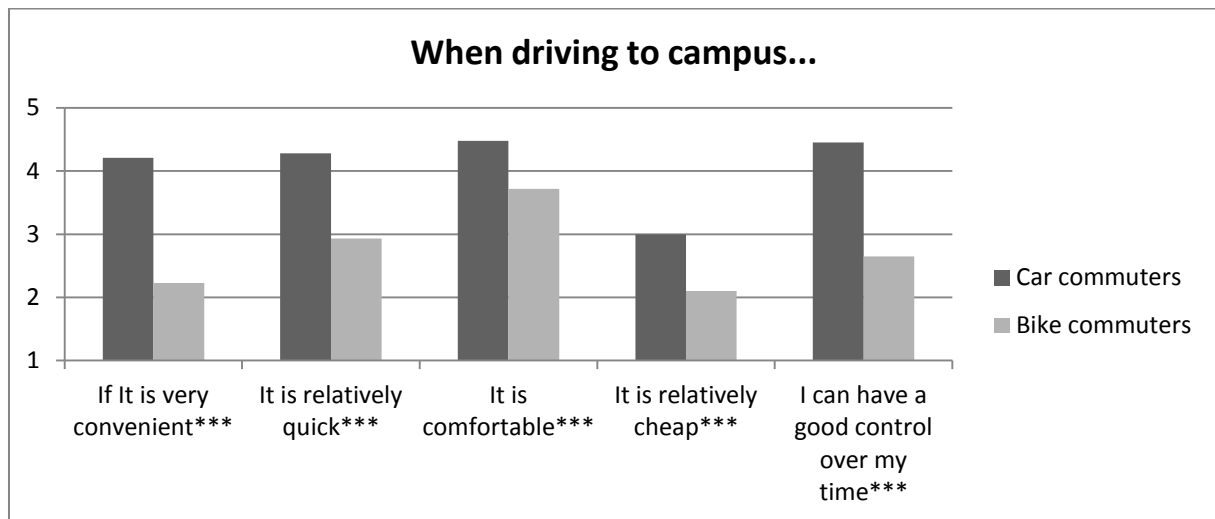


Figure 5 - "When I drive to campus with a car..." (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

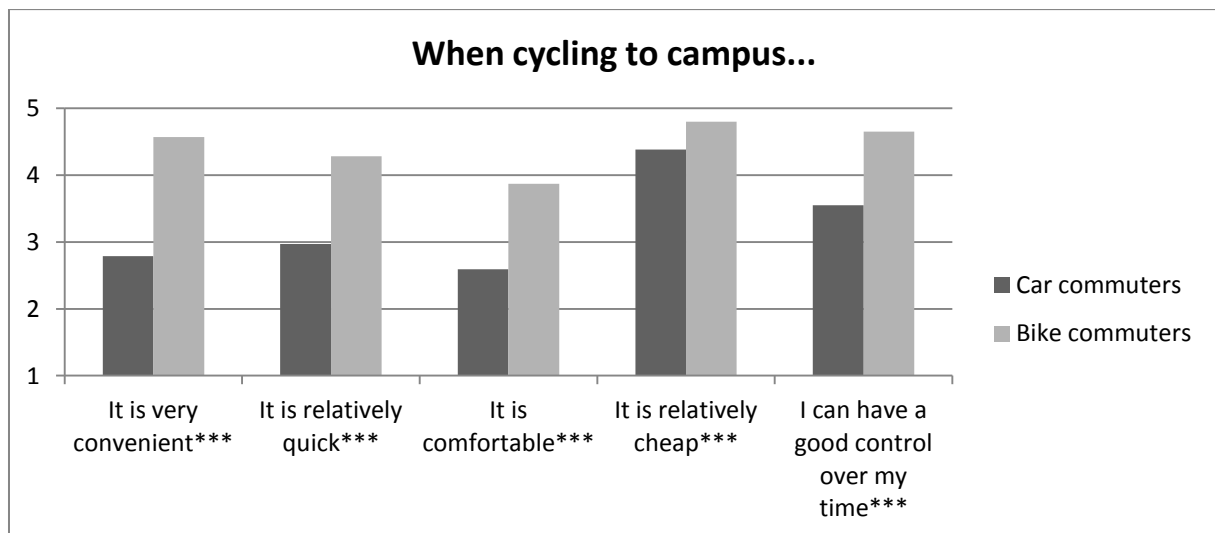


Figure 6 - "When I cycle to campus..." (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

For this last section, a series of multiple regressions were performed in order to see if the variables (I don’t like the idea of cycling to campus) and (I don’t like the idea of driving to campus) are predicted by the factors convenience, speed, comfort, cost and time control for both commuting modes. The former are considered dependent variables, the latter the independent variables.

A multiple regression was first run to predict (I don’t like the idea of cycling to campus) from convenience, speed, comfort, cost and time control when cycling. None of the variables however significantly predicted whether participants dislike the idea of cycling to campus. A second multiple regression was run to



predict (I don't like the idea of driving to campus) from convenience, speed, comfort and time control when driving. The variables statistically significantly predict the extent to which participants dislike the idea of driving, with  $R = .313$ ,  $R^2 = .272$  and  $P < 0.005$ . One independent variable added significantly to the prediction: convenience, with  $B = -.253$  and  $P < 0.05$ . Liking to drive to campus is thus significantly predicted by the extent to which the car is rated convenient.

### 5.1.3 Subjective norm

As mentioned under 3.1.1, subjective norm refers to the perceived social pressure to perform or not to perform behavior. For investigation of this element of the Theory of Planned Behavior, the participants were asked two questions: first, *people important to me would support me in biking to commute to and from campus*, which is a more informal proposition referring to the situation that the participant would choose to ride a bike on his own initiative. Second, *people important to me think that I should use a bike to commute to and from campus*, which investigates actual social pressure. Results are visualized in figure 7.

Again, the answers for both sample groups differ significantly. Bike commuters agree more strongly ( $M = 4.52$ ) that people important to them would support them in riding a bike than car commuters do ( $M = 3.79$ ). Furthermore, bike commuters on average are more positive that people in their surroundings think they should use a bike ( $M = 3.47$ ). Car commuters have a more neutral stance in this respect ( $M = 2.72$ ). The perceived social pressure to ride a bike is thus stronger amongst the bike commuters. This could be an indication that a lack of social pressure to ride bikes is an element that keeps car commuters from cycling to campus.

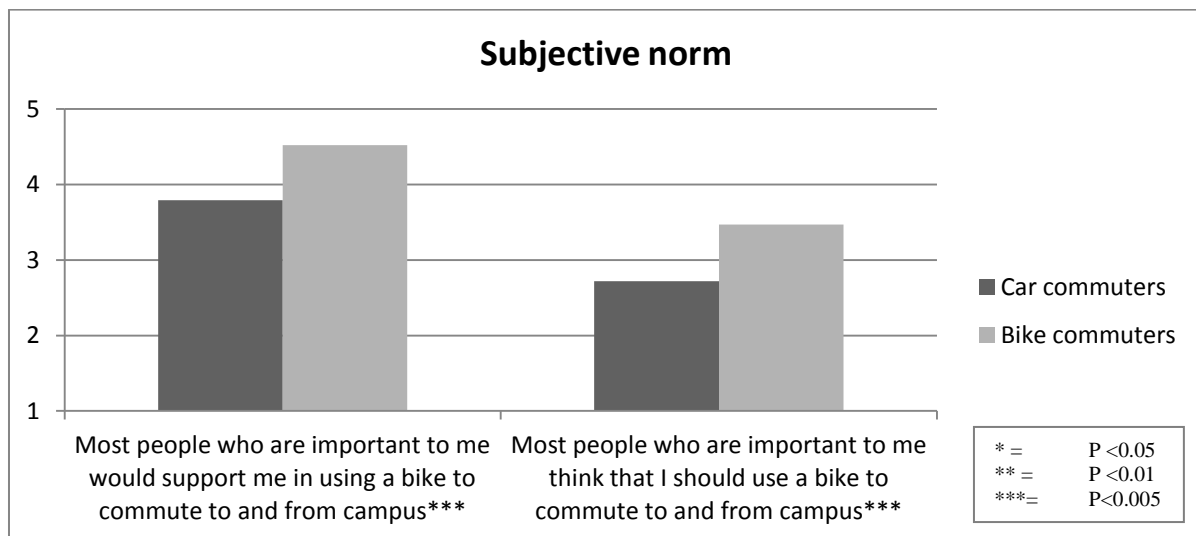


Figure 7 - "Most people who are important to me would support me / think I should use a bike to commute to and from campus (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)"

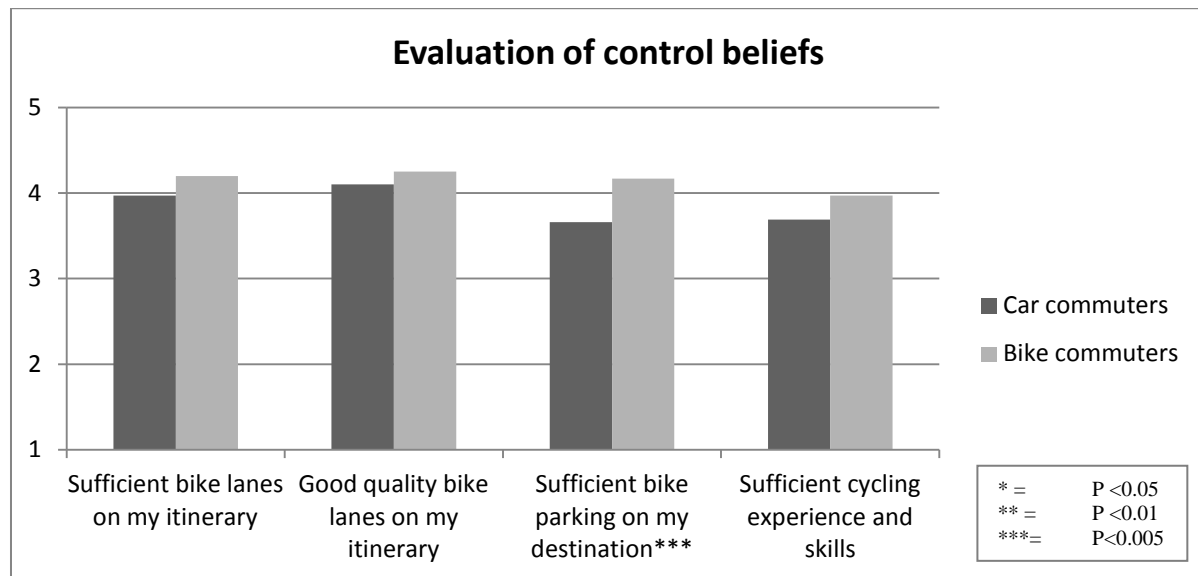
### 5.1.4 Perceived behavioral control

The perceived behavioral control concerns beliefs about the presence of factors that may further or hinder the performance of behavior (Bamberg et al, 2010). People's behavior is strongly influenced by their confidence in their ability to perform it. Therefore, the participants were asked three questions. The first refers simply to the perceived control: how difficult is it for you to bike to campus? (1 = very difficult - 5 = very easy). Answers by differed significantly ( $P < 0.005$ ), with bike commuters claiming that it is easy for them to bike to campus ( $M = 4.25$ ), car commuters on average finding it harder ( $M = 2.76$ ).

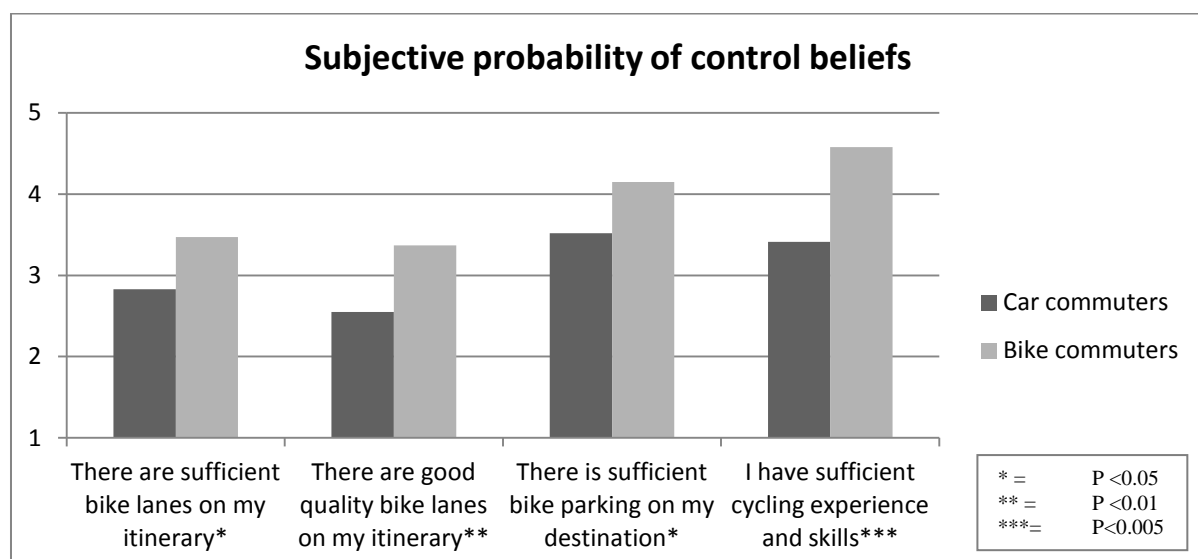
Then, factors that influence this perceived control were investigated. Participants were asked to reflect upon their general beliefs by answering the question how much would the following factors facilitate your decision to commute to campus by bike, factors being 1) sufficient bike lanes on itinerary, 2) good quality bike lanes on itinerary, 3) sufficient bike parking on destination, and 4) sufficient cycling experience and skills (figure 8). Both

groups deem that sufficient and good quality bike lanes, sufficient bike parking and sufficient cycling experience and skill are prerequisites in order to facilitate the decision to commute by bike. Answers differ most for sufficient parking on destination, which bike commuters estimate as significantly more important ( $P = <0.005$ ).

After being asked what importance they accord to these factors, participants were asked to reflect upon them in their specific situations. Data are visualized in figure 9. Answers differ significantly for all elements. Bike commuters are significantly more positive on all aspects. While they are positive they have enough cycling experience and skill ( $M = 4.58$ ), car commuters are less positive ( $M = 3.41$ ) ( $P < 0.005$ ). Bike commuters are carefully positive about the amount of bike lanes ( $M = 3.47$ ) and their quality ( $M = 3.37$ ), while car commuters are significantly less positive for the amount ( $M = 2.83$ ,  $P < 0.05$ ) and quality ( $M = 2.55$ ,  $P < 0.01$ ) of bike lanes on their itinerary to UF campus.



**Figure 8 – “How much would the following factors facilitate your decision to commute to campus by bike?” (1 = not at all facilitating, 2 = not facilitating, 3 = neutral, 4 = facilitating, 5 = very facilitating)\**



**Figure 9 - “The next time that you cycle to campus, how likely will it be that the following statements are true for you?” (1=very unlikely, 2=unlikely 3=neutral 4=likely 5=very likely)**

As in the attitudes section, two series of multiple regressions were performed in the perceived behavioral control section. Goal is to see if the (dependent) variable (*how difficult is it for you to bike to campus*) is predicted by two (independent) variables: first, the extent to which the factors amount of bike lanes, quality of bike lanes,

bike parking on destination and sufficient experience and skill *in general* would predict difficulty (independent variables from Figure 8). And second, if amount and quality of bike lanes, bike parking and experience and skill *in the specific situations* of the commuters would influence the difficulty (independent variables from Figure 9). Regression tables can be found in appendix 9.

The first multiple regression revealed that none of the variables of the *in general* observations significantly predicted whether participants find it difficult. A second multiple regression was run to see if “*the next time that you cycle to campus*”, amount and quality of bike lanes, sufficient parking and experience and skills predict the difficulty to bike to campus. At first, results show that three of the variables add significantly to the prediction: sufficient bike lanes, good quality bike lanes and sufficient cycling experience and skill. However, upon closer inspection, the B<sup>1</sup> coefficients show an anomaly. The coefficients are positive for the independent variables (*good quality bike lanes*) and (*sufficient cycling experience and skill*), which means an increase in these variables decreases the perceived difficulty. However, the B<sup>1</sup> coefficient for (*sufficient bike lanes*) is negative (-.338). This would mean that an increase for the variable (*sufficient bike lanes*) with 1 unit would decrease the overall ease to bike to campus with .338 (since this scale ranged from 1 – very difficult, to 5 – very easy), which doesn’t make sense. Looking at the VIF statistics, the variables (*amount of bike lanes*) and (*good quality bike lanes*) show similar high scores. VIF scores define the multicollinearity among variables; high scores mean variables are highly related and may disrupt the model outcomes. In this case, it is probable that the variables (*sufficient bike lanes*) and (*good quality bike lanes*) are too similar in question. Ruling out the variable (*sufficient bike lanes*) in the multiple regressions shows that both others add significantly to the predictions: good quality bike lanes (B = .259, P < 0.005) and sufficient experience and skills (B = .313, P < 0.005) thus predict the perceived difficulty to bike to campus.

### 5.1.5. Moral norm

As stated under section 3.1.2, moral norm can be regarded as an individual’s perception of the moral correctness or incorrectness of performing a behavior, and take into account of “personal feelings of... responsibility to perform, or to refuse to perform a certain behavior” (Ajzen 1991, p199).

To analyze the sample groups’ moral norm, participants were asked to what extent they agree or disagree with two statements: “I feel guilty about it when I drive to campus by car”, and “I do not feel bad about it when I drive to campus by car”. Again, answers differed significantly for both sample groups (P< 0.005), and for both statements the groups on average were consistent in their opinions and feelings (see figure 10).

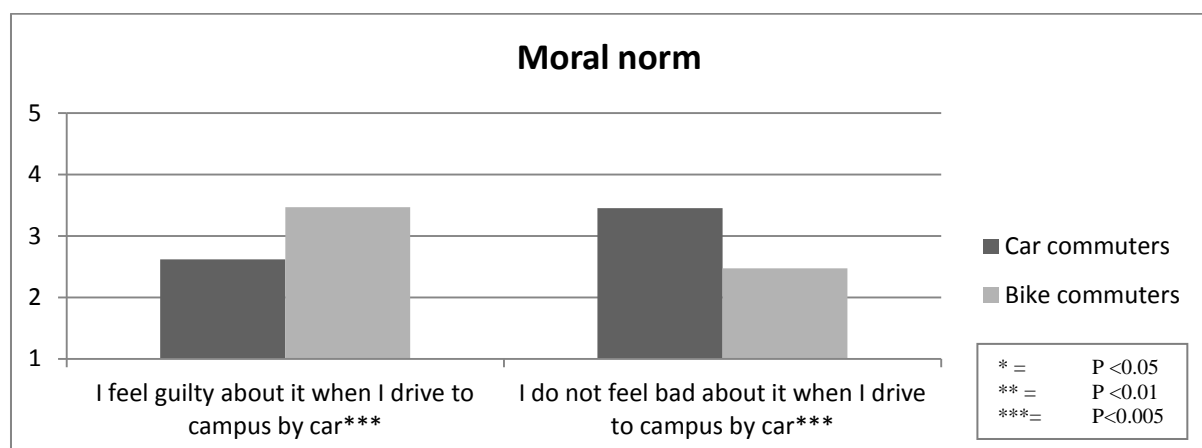


Figure 10 - Moral norm. “I feel guilty / I do not feel bad about it when I drive to campus by car’ (1=strongly disagree 2=disagree 3=neutral 4=agree 5=strongly agree)

Asked if they feel guilty, car commuters slightly disagree ( $M = 2,62$ ) while they agree that they do not feel bad about driving to campus ( $M = 3,25$ ). The opposite is true for the bicycle commuters, who on average feel slightly guilty for traveling to campus by car ( $M = 2,62$ ), and disagree not feeling bad ( $M = 2,47$ ).

#### 5.1.6 Descriptive norm

Descriptive norm refers to the perception of individuals of what most people do. This motivates them to do the same because it provides “evidence as to what will likely be effective and adaptive action” (Cialdini, 1990, p1015). It differs from subjective norm in that it does not concern what friends and relatives ‘think’ of what you do or should do, but rather what friends and relatives actually ‘do’, and how this inherently influences your intention to perform certain behavior. For measurement of the descriptive norm, participants were asked to indicate how many people in their immediate surroundings, friends and colleagues, travel to campus by bike. A significant difference in this number might have proven to be of influence on the decision to commute by bike or not, but this is not the case. Car commuters indicated an average of 6.38 friends and colleagues commuting by bike, while bike commuters indicated a slightly higher (but not significant) number of 7.64 cycling friends and colleagues.

#### 5.1.7 Environmental factors

The environmental factors-section of the survey consists of three different elements: the environmental value rank, used as a measure of the importance of environmental; the awareness of problems caused by car-use, measured with eight questions to which the respondents had to indicate the extent to which they agreed; and the felt responsibility for the problems caused by car-use. The environmental value rank consists of seven different values. Participants were asked to rank the values using numbers 1 to 7, with 1 being most important and 7 being least important.

Results in table 5 show that car and bike commuters don’t rank values significantly different, except for social power; bike commuters find social power to be more important than car commuters. No significant difference can be found for the environmental protection value, although cyclists on average rank this value slightly higher than car commuters.

<i>Value</i>	<i>Car mean</i>	<i>Cycle mean</i>	<i>P-value</i>
<b><i>Social power</i></b>	<b>5.55</b>	<b>4.80</b>	<b>&lt;0.05*</b>
<b><i>True friendship</i></b>	<b>2.90</b>	<b>2.82</b>	<b>0.824</b>
<b><i>Quality of life</i></b>	<b>2.38</b>	<b>2.43</b>	<b>0.894</b>
<b><i>Material wealth</i></b>	<b>5.31</b>	<b>5.58</b>	<b>0.424</b>
<b><i>Protecting the environment</i></b>	<b>4.59</b>	<b>3.92</b>	<b>0.094</b>
<b><i>Authority</i></b>	<b>5.66</b>	<b>5.37</b>	<b>0.376</b>
<b><i>Family security</i></b>	<b>2.31</b>	<b>2.67</b>	<b>0.362</b>

**Table 5 - Environmental value rank. Please rank the values using numbers 1 to 7, with 1 being most important and 7 being least important**

For investigation of the problem awareness, participants were asked eight different questions on car commuting and the environment. For three questions, car and bike commuters’ answers differ significantly. Bike commuters agree significantly more strongly with the statement that car use causes serious air pollution in the world ( $P < 0.05$ ). Also, they agree significantly more with the statement that car use is a major source of noise problems in Gainesville ( $P < 0.05$ ). Third, car commuters agree significantly more strongly with the statement that ‘many neighborhoods in Gainesville are unsafe because there is too much traffic’ ( $P < 0.05$ ).

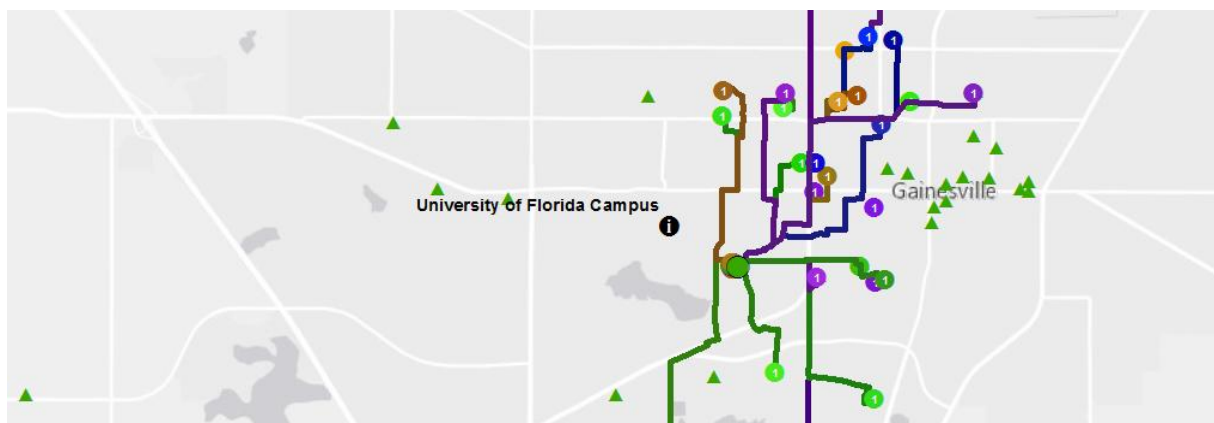
For the last question in the Environmental factors section, participants were asked to what extent they agree or disagree with the statement ‘I personally feel responsible for the problems resulting from car use when I drive’. Car commuters on average are neutral, but tend to slightly disagree ( $M = 2.9$ ), while, bike commuters tend to slightly agree ( $M = 3.2$ ). But no significant difference in degree of felt responsibility was found.

## 5.2 Origin destination mapping

### 5.2.1 Estimated versus measured distance

The last section of the questionnaire, participants were asked to indicate their origins and destinations when traveling to UF campus by car or bike. It was explained earlier how the map was built and inserted in the Qualtrics online survey. After closing the survey, coordinate data were retrieved from Qualtrics. With 89 respondents, 89 origin points (29 for car commuters and 60 for bike commuters) and 89 destination points were converted to Degree Minutes in the WGS\_1984 geographic reference system. In Excel, the data was classified in four categories: origins of car commuters, destinations of car commuters, origins of bike commuters and destinations of bike commuters. Maps of data overview and the classified data can be found in appendix (10) .

At the beginning of the survey, participants were asked to estimate the distance between home and their destination on University of Florida campus. There proved to be a significant difference in average estimated distances, with car commuters estimating an average of 4.57 miles and cyclists an average of 2.67 miles between home and work. However, for a comparison of estimated and actual commuting distances to campus, an additional selection of values to leave out of the calculations had to be made. In the survey, commuters could only pinpoint the origin of their commute up to a distance of approximately 9 miles. However, some of the car and bike commuters travel more than this distance to campus every day. They weren’t offered the possibility to pinpoint this accurately on the origin-destination map. To make the comparison a correct one, these data outliers had to be removed out of both the estimated distance and the pinpointed distance. For the car commuters, three cases over 10 miles were left out; for the cyclists two. After this calculation the average estimated distance between home and work for car commuters comes to 3.55 miles; the average estimated distance between home and work for bike commuters comes to 2.22 miles.



**Figure 11 - Example of calculations of shortest routes between origins and mean center destination of cyclists**

The point data retrieved through the survey can show to what extent commuters estimate their distances right. This is calculated using the Network Analysis tool in ArcGIS. First, the destinations on UF campus were looked at. For both car and bike commuters’ destinations on campus, an average mean point was calculated using the Mean Center Tool in ArcGIS. Next, a network was built from the Tiger\_roads layer downloaded from the online library. For each of the datasets containing the car commuter and bike commuter origins, the shortest routes were calculated from the origins to the Mean Center on UF campus (see figure 11).

The total of distances for the routes was accumulated and divided by the number of routes. As such, the actual average distance from home to campus was calculated for both cyclists and automobilists. Results are shown in table 6 below;

	Estimated av. distance home to campus	Measured av. distance home to campus
<b>Car commuters</b>	<b>3,55 miles</b>	<b>3,11 miles</b>
<b>Bike commuters</b>	<b>2,22 miles</b>	<b>1,86 miles</b>

**Table 6 - Estimated versus actual average distances between home and work on campus, in miles**

The network analysis shows that both the car and bike commuters on average travel a distance shorter than what they estimate. Estimating a longer commute might lead to a different route choice. However, this discrepancy in estimated and actual distance can be caused by several factors;

- For calculation of the actual average commuting distance, the ArcGIS Network Analysis tool calculates the shortest route from origin to destination. It might very well be that commuters don't always know the shortest route from home to work. Also, they might choose to differ from it, which results in a longer average commuting distance.
- For calculation of the actual average commuting distance, the ArcGIS Network Analysis tool used a Network Dataset built from a GIS dataset of the Florida Dept of Transportation. However, there is no guarantee that this dataset is a complete one, including all possible road sections, links and connections. The Dataset is only a representation of reality.
- For calculation of the shortest route, a Mean Center tool was used to calculate the average destination of car and bike commuters. However, research participants in reality commute to different areas of UF campus, adding to the distance traveled.

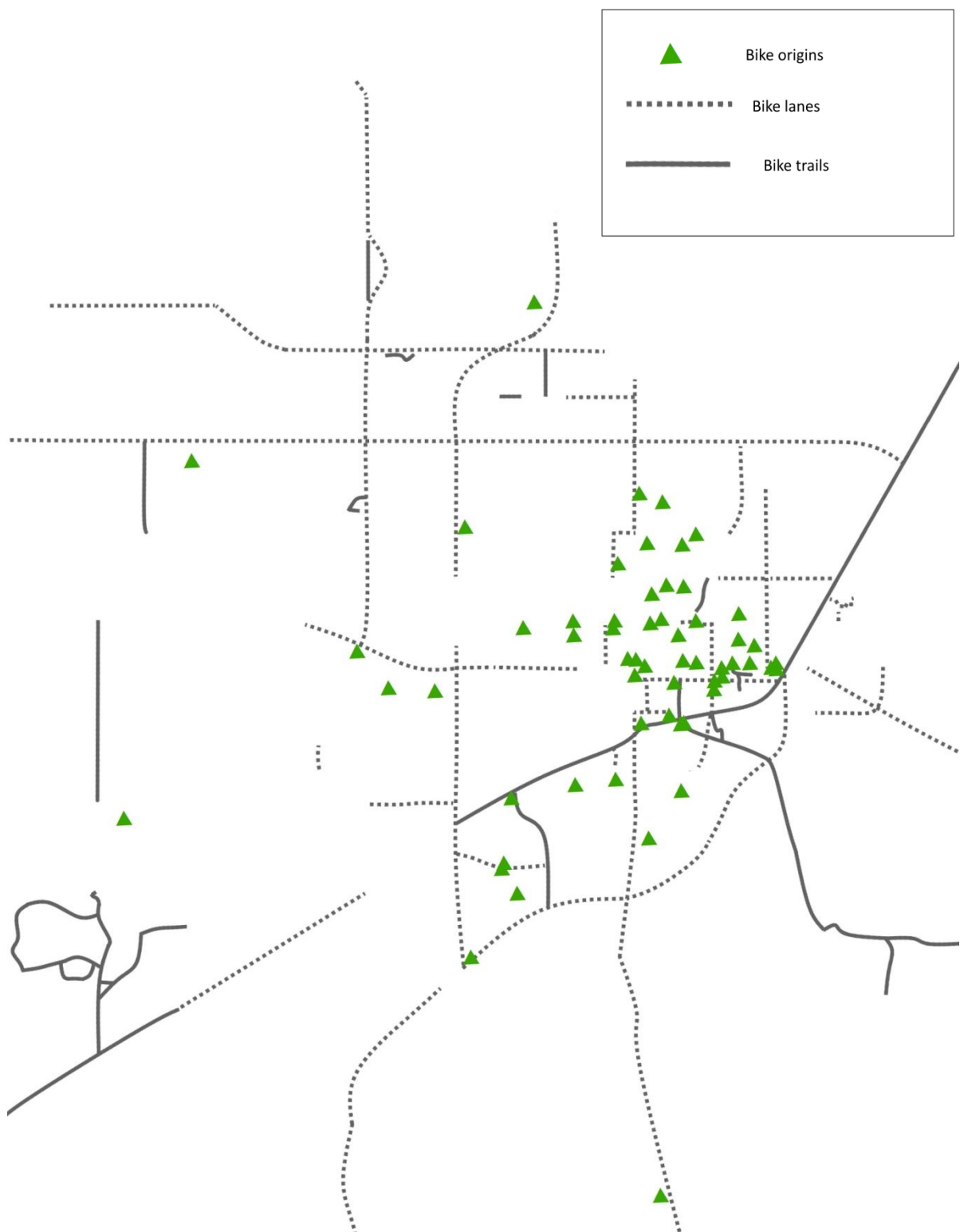
### 5.2.2 Origin-destination and bike infrastructure

The location data retrieved through the origin-destination mapping section can be used for more than just distance analysis. Below are two maps (figure 12, 13). Visualized are all bike lanes and bike trails in Alachua County. Since this research consists of studying commuting *to* campus, on-campus bicycle infrastructure is left out. Projected on this visualization of bicycle infrastructure are origins of bike commuters (figure 12) and origins of car commuters (figure 13).

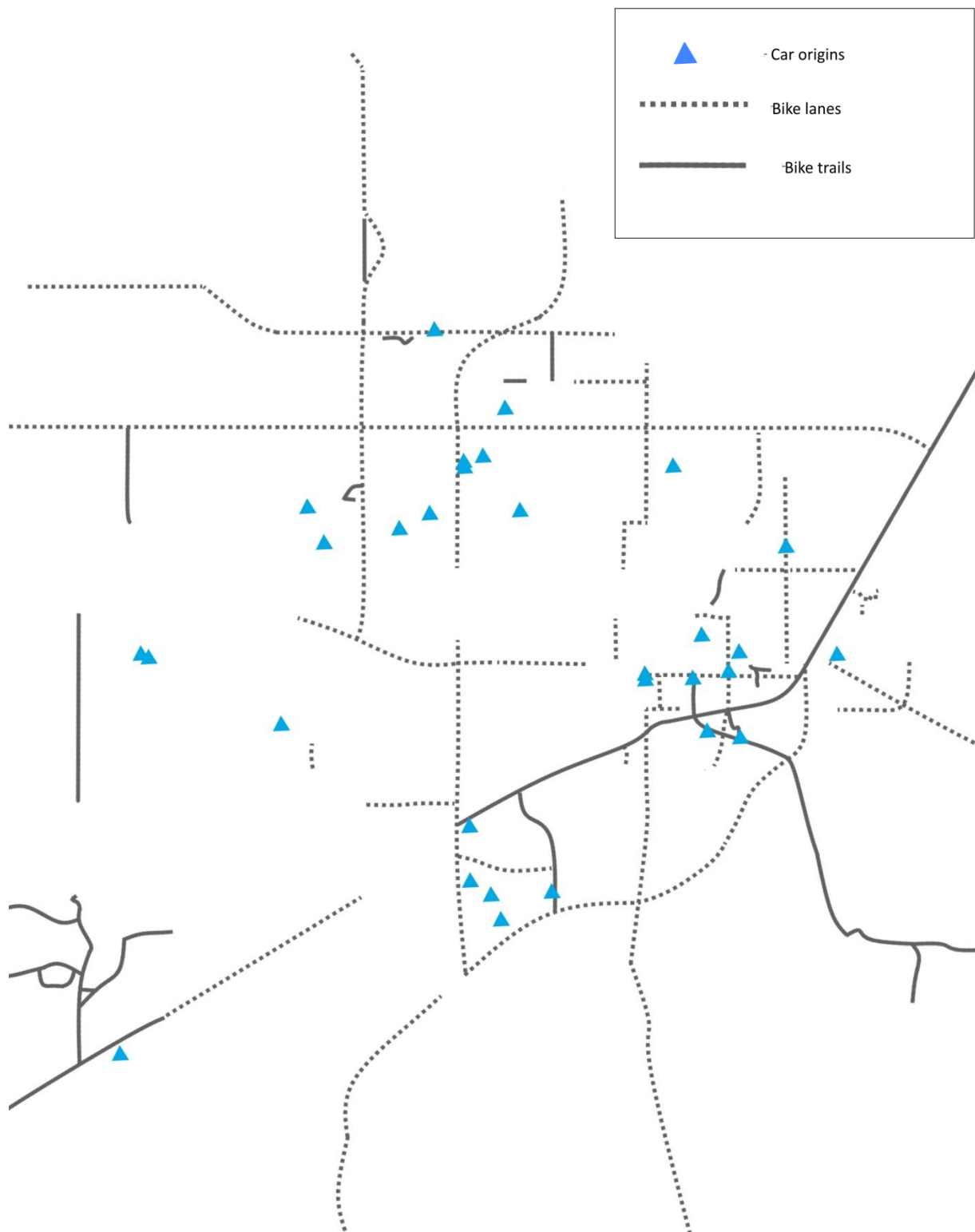
Looking at the maps, the bicycle infrastructure in Alachua County predominantly consists of on-road bike lanes (dotted lines). The only continuous bike trail, separated from traffic, runs from the Archer road intersection south of campus, along Depot Avenue and south of downtown, all the way up to Gainesville Regional Airport. For the rest of Gainesville, commuters have to make use of on-road bike lanes or ride on streets without bike lanes. As can be seen in figure 12, a large concentration of bike commuters originate around the downtown (east) area. From downtown to campus, the 2<sup>nd</sup> Avenue on-road bike lanes provide the connection with north of campus, while south of campus can be reached using the Depot Avenue trail. For commuters north, west and south of campus (where also a lot of car commuters originate), very little adequate and continuous infrastructure is available on horizontal and vertical axes; the infrastructure available consists of on-road facilities. For cyclists, tension arises between making use of bike infrastructure (and relative safety, but having to bike a detour) or bike on-road without infrastructure (and endure safety issues, while biking the shortest route).

Lacking infrastructure can be a difficulty and obstruction to commute by bike for both bike and car commuters: Heinen et al (2010) state that continuity of bicycle infrastructure is important, since route segments with no cycling facilities could deter some people from cycling. Stinson & Bhat (2003) indeed find that cyclists

have a negative perception of the sudden ending of a facility. The implication of this for the modal share for bicycle commuting in Gainesville will be discussed under section 6.



**Figure 12 - Bike lanes and bike trails in Alachua County, with visualization of bike commuter origins (Data: Google Maps, own survey data; edited in Adobe Photoshop, ArcGIS)**



**Figure 13 - Bike lanes and bike trails in Alachua County, with visualization of car commuter origins (Data: Google Maps, own survey data; edited in Adobe Photoshop, ArcGIS)**



### **5.3 GPS/Interviews**

Below, the outcomes of the in-depth interviews in combination with the GPS video data will be discussed. The interview guide (appendix 5) provides the structure for how the results will be discussed. Three participants agreed to take part in the section with the GPS camera. After they taped their commute, an in-depth interview was held to discuss their daily itinerary to and from campus, and how this commute is affected by different factors.

In section 4.4.2 of the methods section, it was explained that the principles and process of developing grounded theory are used for this section of research. One of the characteristics of grounded theory is that “analytic concepts are constructed inductively from data and not from deductive theories” (Hennink et al, 2011). However, it is acknowledged that building theory is an ongoing exchange between existing theory and new insights. This is especially relevant for this section of analysis: the factors researched and the themes for the interviews were identified from existing literature. In section 3.2, it is explained that a wide variety of factors have been found to influence commuting by bicycle. In this section, factors that influence the actual commuting trip to campus are researched. Using the overview by Heinen et al. (2010, see table 3, section 3.2), this most notably covers the factors built and natural environment and associated travel time and safety. Factors referring to the decision to commute by bicycle are researched mostly through the survey; however, to balance with the findings from the survey, also the decision making process will be examined. As the process of developing grounded theory is an exchange between existing theory and new insights, existing literature on the mentioned factors will be examined. The codes developed in the codebook (appendix 12) will be linked with existing theory and quotes from the in-depth interviews (appendix 13) in order to develop and interpret the empirical data. Where possible and relevant, video stills will be added as illustration.

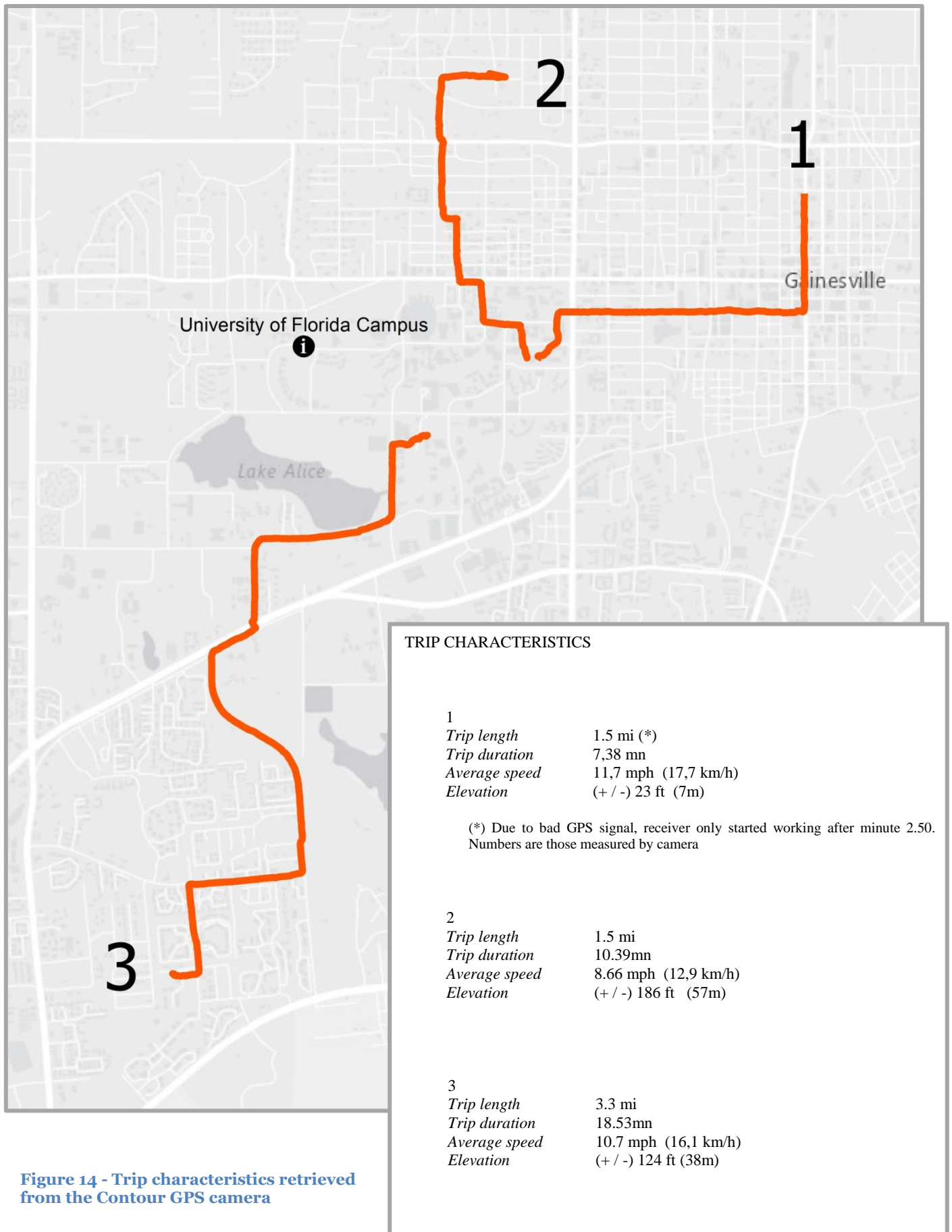
Below, first the characteristics of the three recorded trips will be discussed. Then, the decision to cycle to work will be discussed. Following this, the focus will be upon the built and natural environment and factors such as travel time and safety.

#### **5.3.1. Participant trip characteristics**

Three trips were registered using the Contour GPS camera, visualized in figure 14. The trips varied from 1.5 to 3.3 miles in length, and were no more than 20 minutes of duration. Participant 1 had the highest average cycling speed with 11.7 mph. This can be attributed to factors such as calm traffic, the relative lack of major intersections and turns compared to the other trips, and the minimal difference in elevation during the trip (23 feet). Heinen et al (2010) state that slopes have a negative impact on cycling. This is illustrated by trip 2, which combines the highest difference in elevation with the lowest average speed. Trip three is the longest trip of all, covering 3.3 miles in about 19 minutes. It is the best example of lack of efficient (cycling) infrastructure discussed under 5.2.2, which seems to lead to big detours in the commute. Heinen et al (2010) state Southworth (2005) to argue that a denser road structure is more suitable for non-motorized transportation, because distances are generally smaller: “the more fine-grained the network, the less difference there is between the network distance and the distance as the crow flies (..) distances are shorter, and consequently can be bridged more easily (..)” (Heinen et al, 2010, p62). An example is the comparison of trip 2 and 3: trip 2 is the most straightforward commute, with visibly less detours than trip 3.

#### **5.3.2 The decision to commute by bike**

As discussed in the background section of this thesis, there are multiple reasons to prioritize commuting by bike over other using other forms of transport. The bike is a non-polluting transport mode that helps to improve air quality and helps alleviate automobile-related problems such as traffic congestion and associated environmental damage. Furthermore, cycling infrastructure is relatively cheap, and more cycling leads to an improvement in public health (Pucher & Buehler, 2010; Stinson & Bhat, 2004; Stinson & Bhat, 2003; Olde Kalter, 2007).



**Figure 14 - Trip characteristics retrieved from the Contour GPS camera**

On a personal level, cycling is a healthy and cheap form of transport. Furthermore, it sometimes proves to be faster than other transport modes (Olde Kalter, 2007). However, there are a number of disadvantages to cycling. Heinen et al (2010) state greater physical effort, the difficulty of carrying loads while cycling, weather, and - for longer distances - traveling slower than other modes of transportation. Furthermore, factors as physical effort and speed also limit the distance a cyclist can travel.

A wide variety of motivations for commuting by bike was mentioned by the interviewees. Coding the interviews, the motivation most mentioned is that interviewees simply tend to “like cycling” (see box 1). Alongside ‘liking’ commuting by bike, the speed and convenience mentioned by Olde Kalter (2007) are an important second motivator for all three respondents. One respondent mentions the ‘hassle’ of the parking garage as an objection to coming to campus by car. The third most important motive is the exercise it provides, an argument that relates to the benefits for the public health mentioned by Pucher & Buehler (2010), such as reduced obesity and blood pressure due to physical activity and fitness. Cycling is potentially a welcome way to perform physical activity for people for which work-related activities aren’t physically challenging. The last factors of motivation were mentioned in one sentence: the cost-aspect of cycling to work (“the fact that I’m not spending that much gas on my car”) and the conservation-aspect (“I’m producing less pollution, there’s less automobiles on the road, so I guess conservation issues”). Respondent 2 was the only one mentioning these factors as motivators to bike. Previously referring to the ‘hassle’ of parking the car, this respondent is most clearly justifying the commute by bike by contrasting it from - and mentioning the downsides of - driving to campus. Both other respondents articulate their choice for the bike more clearly from a standpoint of the benefits of cycling rather than the downsides of driving.

As mentioned, “liking” to ride the bike is considered a very important motivator. In their research on affective appraisals of commuting modes, Gatersleben & Uzell (2007) find that cycling trips to work score high on the factors pleasure and arousal, and that these trips are considered to be the most interesting and exciting compared to car and bus-rides. However, they acknowledge that the subjective feeling of ‘liking’ cycling is highly dependent on external factors that often can’t directly be influenced by the cyclist, such as weather and climate, a perceived difficulty to commuting by bike that is most mentioned by the respondents. Both Nankervis (1999) and Brandenburg et al (2007) state that a relationship exists between weather conditions and cycling and that thermal condition tends to be more important than rainfall for the commuters’ decision-making. This is very well illustrated by quotes from respondent 2: the respondent states to simply ‘deal with the rain’; however, considering the Florida climate, the respondent acknowledges that “Gainesville can get pretty hot”, and that “shade is a big thing” (see still 1, box 2 and 3). The respondent sees this as a factor that might withdraw others from cycling to work.

Heinen et al (2010) stated the problem of carrying-on heavy loads when commuting by bicycle. One respondent sees this as problematic and mentions this is a reason to sometimes commute to campus by car.

### **5.3.3 The commuting route**

After opening the in-depth interviews with the motivations for commuting by bicycle, respondents were asked the simple question of ‘why they bike the way they bike’. That is, what are their motivations for choosing their specific itineraries? Results from the survey show that the quality of bike lanes is a significant predictor of the perceived ease or difficulty to bike to campus. The origin-destination mapping showed that the density and continuity of bicycle infrastructure in Gainesville is questionable, which could deter people from cycling (Heinen et al, 2010). How do respondents then choose their itineraries?

The most important motivator for the itinerary that is biked to work is safety (see appendix 13 box 3, video still 2 and 3). Safety is influenced both by available cycling infrastructure and levels of traffic. A respondent acknowledges having changed itineraries over time, because the initial itinerary proved more dangerous. Low traffic and uncomplicated traffic situations are valued. For some, speed and amount of other traffic is a reason to

avoid certain streets or occasionally change itineraries. The behavior of other traffic is considered more important in route choice than the availability of infrastructure. This finding is supported by previous research: Hunt & Abraham (2007) state that “those who are highly comfortable in mixed traffic are relatively indifferent to cycling facility type”. However, the absence of any cycling facility is for some respondents reason to avoid certain streets. The second important motivator for the current itinerary is habit and repetition. Little consideration of this factor has been found in the academic literature, where route length or directness of the trip are often seen as the factors influencing trip behavior (Hunt & Abraham, 2007). One respondent talked about his itinerary as a habit he established in a new environment. Another talked about the repetitive character of the route, important when ‘having your mind set upon other things’: “I know exactly what’s going on (..) you know the road (..) the conditions of them, what to expect (..).



Video still 2 – Cycling and climate

On motivation to cycle

- “Gainesville can get pretty hot, you know. (..) August and July, it’s just.. pff.”. (..) “I think [others] are worried they’re going to sweat (..) that you have to get dressed in a sporty way”

On comfort of itinerary

- “It has to be comfortable (..) In the summer, it’s shady. You know, and that is a big thing”



Video still 3 - Cycling and other traffic

Cycling in a Gainesville residential neighborhood with low traffic and good visibility. On traffic safety:

- “I used to do a different route, but then I saw a traffic study, and the intersection I used everyday had the highest accident rate (..) So then I said I’ll change, I take another one, it’s a much quieter road and it works much better”



### 5.3.4 Infrastructure on the commuting route

Respondents are carefully positive on the general state of cycling in Gainesville, recognizing it is a “pretty supportive city for cycling”. Using the data from the origin-destination mapping, section 5.2.2 showed that the density and continuity of bicycle infrastructure in Gainesville is questionable. Respondents agree that the increase in number of bike lanes is necessary. A constant level of quality of the lanes is considered a problem: “routes in some areas are really well done, and others are just sort of ignored”. Maintenance is considered necessary (video still 4)

Heinen et al (2010) make a distinction by objective and subjective safety when it comes to infrastructure: objective infrastructure is measured in terms of number of bicycle-related incidents per million inhabitants. Subjective safety refers to how individuals perceive safety.



Video still 4 - Cycling and other traffic (2)

Dealing with other traffic is considered more problematic to cycling than the eventual lack of cycling infrastructure.

- “Buses are the worst (..) I find them to be very aggressive”

- “They’re driving too fast. There are people driving with children, and they’re just not paying a lot of attention”



Video still 4 - Cycling and the state of infrastructure

Whereas Gainesville is considered pretty supportive for cycling, improvements in amount and quality of lanes must be made.

“Maintenance (..) and increase of bike lanes would be very good”

- “Some parts of the road are really bumpy. It’s like, every time I ride there it’s like, do I have a flat tire or something?”

Talking about the recent addition of markings on bike lanes, one respondent refers to this experienced safety (Video still 5), claiming “not feeling any safer” by having the paint on the ground. No evidence was found in literature that such markings help improve the objective safety by for example increasing car awareness. However, respondents themselves state that the installation of so-called vibrating strips would help improve both the objective and subjective safety. “It would make me feel safer (..) The driver as soon as he goes over there, he’s like, wait a minute!” A third remark regarding infrastructure and safety is made regarding traffic slowing measures that obstruct cycling and force cyclists into potentially dangerous situations (video still 6).



Video still 5 - Cycling and subjective safety



Video still 6 - Cycling and traffic calming measures

Engineering traffic with the cyclist in mind;

- “they put these things in for traffic calming (..) it’s these little planters with curves, but there’s no place for the bikers to go, so I have to go and come to the middle of the lane”.

“If traffic engineers kept the bicycle in mind every time they make a decision (..) like these stupid bump-outs (..) every time you make a decision, don’t just consider the car, consider the pedestrians and consider cyclists..”



### 5.3.5 Dealing with lacking infrastructure

Hunt & Abraham (2007) state that cyclists prefer bike paths to both on-road bike lanes and roads without bicycle facilities. Origin destination mapping showed that bike trails and bike lanes are not that frequent. In addition to their comments upon the current state of infrastructure, respondents were asked how they deal with lacking bike infrastructure. There was not one recurring answer to this question. One respondent decidedly responded to go on the road, since *“there’s no option really”* (see video still 7). Another respondent discussed the dilemma faced when no infrastructure is available: going on-street, cyclists are faced with the potential frustration and careless driving of automobilists. Although staying with the traffic flow might be safer from an objective point of view, this is not the subjective experience of the cyclists, who as a consequence move to the sidewalks. There, *“new issues emerge, because [pedestrians] are usually plugged into their music (..) They don’t hear you, they don’t move.”*



Video still 7 – Cycling and mixing with traffic

#### Mixing with traffic

- *“I go on the road. There’s no other option really”*
- *“I understand the frustration [of drivers], if you’re in a major arterial system, where speeds are 45 and higher, and there’s no bicycle lanes (..) and you encounter a bicyclist in the roadways, people are irritated (..) So, I understand that, and I tend to go to the sidewalks.”*



#### Going on the sidewalk;

- *“New issues emerge, because, they [pedestrians] usually plugged into their music (..) they don’t hear you, they don’t move”.*

Video still 8 - Cycling and going on the sidewalk

Petritsch et al (2006) state that separated bike paths should be constructed for roads with speeds higher than 40 mph, rather than bike lanes. Respondents argue that denying cyclists the access to the sidewalk in exchange for a fixed spot among traffic flows would probably be an ideal condition. *“or, or you should provide a widening of sidewalks which gives the option for cyclists and (...) other people.. But that kind of infrastructure is really expensive, particularly when things are already set (...) I don’t see that being practical, given state budgets, you know..”* (...) Continuing: *“Maybe you have to look at (...) where population centers are where people are more likely to bike, or commute (...) sometimes it seems that infrastructure expense could have been put somewhere else (...) a strategic analysis of possibilities of bike lanes for commuting (...) would be a good use.. Despite diminishing resources, you can make an ideal bike network.”*

## 5.4 Summary of results

In previous sections, a mixed-methods approach was used to come to leads on what can be done to increase bike-use for commuting to and from UF campus in Gainesville. Below, the most important results found using these different methods are summarized. Only the results estimated important for answering the research questions are taken into account. In section 6, the research questions will be answered combining the results from the different methods, and an attempt at a conclusion will be made. In the table below, bike commuters will be referred to as ‘cyclists’, car commuters as ‘automobilist’

Method	Section	Findings	Connection
Survey	Gen 1	Cyclists do significantly more cycling in their free time than automobilists do	
	Gen 2	There is a significant difference in estimated commuting distance, automobilists traveling a longer estimated distance to campus than cyclist	Dist 1
	Att 1	The cost of a transportation mode is significantly more important to cyclists than to automobilists in their choice for a transport mode	Dec 1
	Att 2	Cyclists are significantly more positive about commuting by bike than automobilists, and find that the bike is convenient, quick, comfortable, relatively cheap and offers good time control	Dec 1
	Att 3	Automobilists are significantly more positive about commuting by car than cyclists, and find that driving to campus is convenient, quick, comfortable, and offers good time control. They are neutral on the cost-aspect of the car.	Att 5, Dist 1, Dist 3, Infr 1, Infr 2, Dec 2, Att 6
	Att 4	Automobilists don’t think cycling is comfortable. They doubt that cycling is convenient or relatively quick. They are positive cycling offers good control over time, and agree more strongly it is relatively cheap.	Dist 1, Infr 3
	Att 5	Both automobilists and cyclists disagree that they wouldn’t like the idea of cycling to campus.	Att 3, Att 4
	Att 6	The variable ‘convenience’ significantly predicts the extent to which participants dislike the idea of driving. The more convenient driving to campus, the less driving is ‘disliked’.	Att 3, Dec 1
	Sub n 1	Cyclists agree significantly more strongly that people important to them both would support them and think they should use a bike to commute to campus.	D nor 1
	Sub n 2	Automobilists agree most people important to them would support them in cycling to campus, but disagree these people think they ‘should’ cycle to campus.	D nor 1
	PBC 1	Automobilists overall find it significantly less easy to bike to campus	Dist 1, Dist 3, Infr 2
	PBC 2	Automobilists are significantly less positive that they will find sufficient and good quality bike lanes on their itinerary, sufficient bike parking on destination, and that they will have sufficient cycling experience and skill.	Infr 2, Trip 1
	PBC 3	The variables ‘good quality bike lanes’ and ‘sufficient experience and skill’ significantly predict the perceived difficulty of cycling to campus.	PBC 1, PBC 2, Infr 2, Trip 1
	M nor 1	Cyclists feel significantly more guilty about driving to campus by car	Dec 1



	D nor 1	There was no significant difference between number of friends and relatives cycling to work for automobilists or cyclists.	Sub n 1, 2
	Val r 1	Cyclists do not value environmental protection as significantly different from automobilists	Aw 1
	Aw 1	Cyclists agree significantly more with the statement that car use causes serious air pollution in the world	Val r 1
	Aw 2	Cyclists agree significantly more that car use is a major source of noise problems in Gainesville.	
	Aw 3	Cyclists agree significantly more that many neighborhoods in Gainesville are unsafe because there is too much traffic	
	Resp 1	There s no significant difference in the extent to which automobilists or cyclists personally feel responsible for the problems resulting from car use when driving	Val r 1
Origin-Dest mapping	Dist 1	Network analysis shows that both automobilists and cyclists on average travel a distance shorter than what they estimate, automobilist living further away than cyclists	Gen 2, Att 3, PBC 1
	Dist 2	Cyclists originate west, SW and NW of UF campus mostly	
	Dist 3	Automobilist origins are scattered over Gainesville	Att 3, PBC 1
	Infr 1	Bike infra in Alachua County predominantly consist of on-road bike lanes, with the highest infra density west of UF campus and around downtown	Att 3
	Infr 2	North, east and south of UF campus, little adequate and continuous infrastructure is available on horizontal and vertical axes	Att 3, PBC1
GPS Intvws	Trip 1	Denser, fine-grained cycling infrastructure is more suitable for cycling as it leads to smaller distances that can be bridged more easily	
	Dec 1	'Like cycling' is the most mentioned reason to commute by bike. Contributing factors are speed and convenience and the exercise required to come to work. Costs and conservation issues are mentioned, but are not leading motives	Att 1, Att 2, Att 3, M nor 1
	Dec 2	Most discussed as influencing cycling is the weather, with both thermal conditions and rain possibly withdrawing others from cycling to work	
	Com r 1	Recurring theme important for choosing the commuting route is safety, influenced by both available cycling infra and levels of traffic	
	Com r 2	Behavior of other traffic is considered more important than availability of infrastructure in shaping subjective safety	
	Com r 3	Habit and repetition is also mentioned as being important in commuting route choice	
	Infra 1	Ameliorations need to be made in both amount and quality of bike infrastructure	
	Infra 2	Additional ground markings don't add to the subjective safety of cyclists – vibrating strips are considered a good alternative	
	Infra 3	Traffic engineering with the cyclists in mind is considered needed	
	Lack 1	Respondents either move to the sidewalk or in-traffic when bike infra is lacking	
	Lack 2	Moving in-traffic brings along safety hazards due to lack of protection and difference in speeds	
	Lack 3	Moving to the sidewalk, cyclists find themselves conflicted with flow movements of pedestrians	
	Sol 1	Either a widening of sidewalks or denying cyclists access to sidewalks in exchange for fixed a spot among traffic flows would be an ideal solution, however financially impossible to realize	
	Sol 2	Strategic analysis of population centers where people are more likely to bike – in order to construct an ideal network – might be a viable solution financially	

Table 7 - Summary of results



## 6. Conclusion

### 6.1 Answers to research questions

In this concluding section, the theory from section 3 and the results from section 5 will be discussed jointly in order to come to a synthesis and answer the research questions formulated in section 1. As mentioned in the introduction, the aim of this research is to:

*Compare car and bike user norms and attitudes towards bicycle commuting, and assess the daily experience and behavior of bicycle commuters in order to propose changes to increase bike use.*

Four research questions were formulated to fulfill the research aim;

1. How do norms and attitudes towards bicycle commuting differ between car and bike users?
2. How does commuting behavior differ between car and bike users?
3. What factors influence cyclists' daily commute to UF campus?
4. What can be done to increase the attractiveness of commuting by bike and stimulate more people to commute by bicycle?

The research consisted of two distinct phases. The first phase studied both bike and car commuters through a survey and origin destination mapping, with the purpose of answering how norms and attitudes towards bicycle commuting differ between car and bike users. The difference in commuting behavior, the second research question, was partly investigated through the origin-destination mapping in the survey and GPS interviews, forming the overlap between the two phases. The second research phase consisted of an investigation of factors influencing the daily commute by bike, using a combination of video footage and GPS-data of the commute, and in-depth interviews.

The data collection for this research was done through a mixed method approach. The added value of the conjoint use of different methods is that the resulting whole is greater than the sum of its parts, as weaving together diverse research techniques allows “to fill gaps, add contexts, envision multiple truths, play different sources of data off each other and provide a sense of both the general and the particular (Cope & Elwood, 2009). Following, each research question will be discussed and an attempt will be made at formulating answers. To use the advantage of having different sources of data collection, those sources and their results will be combined to answer the specific research questions. The structure for the discussion of the research questions was provided in section 5.4. The discussion of results will be provided in section 6.2, the reflection in section 6.3.

#### *1. How do norms and attitudes towards bicycle commuting differ between car and bike users?*

Norms, attitudes, and the additional components of the (extended) Theory of Planned Behavior provide the theoretical basis for the first section of research and the first research question. The Theory describes that an individual's intention to perform a certain behavior is formed by the total of six motivational factors: attitudes, subjective, descriptive and moral norms, perceived behavioral control, and values and perceptions related to the environment. A comparative study of these factors between car and bike commuters intends to uncover reasons why these two groups perform different behavior, and why car commuters decide to commute by car rather than by bike.

Results show that attitudes play a central role in this decision. Car commuters are significantly more positive about commuting by car than cyclists, and experience driving to campus as convenient, quick,

comfortable, and offering good time control. They don't think cycling to campus would be comfortable, and doubt that cycling is convenient or relatively quick. Surprising is the fact that car commuters are not negative towards bicycle commuting: asked if they dislike the idea of cycling to campus, they disagree.

The negative perception of car commuters regarding comfort and convenience of the cycling is reflected in their perceived ability to perform it. Convenience significantly contributes to the fact that people like to commute by car. Overall, car commuters find it significantly less easy to bike to campus than cyclists do: they are significantly less positive they have sufficient and good quality bike lanes on their itinerary, and they doubt they have sufficient cycling experience and skill to come to campus by bike. These two factors proved to significantly influence the perceived difficulty to bike to campus.

The perceived difficulties and resulting negative attitudes of car commuters towards commuting by bike can partly be explained by an analysis of available bike infrastructure. Origin-destination mapping shows that little adequate and continuous bike infrastructure is available in areas where most of the car commuters reside. A lack of (continuous) infrastructure seems to be a major discouragement as it affects both objective (measured) and subjective (felt) safety. Both previous research and results from the interviews show that a lack of this infrastructure is problematic, as moving in-traffic or on the sidewalk causes conflicts with other traffic flows, affecting safety, comfort and convenience of the commute.

Car commuters feel significantly less guilty about coming to campus by car than cyclists would. They are less convinced that people around them support or expect them to ride a bike to campus. Asked about the extent to which they personally feel responsible for problems resulting from car use, both groups responded neutral. While cyclists agree significantly more that cars cause serious air pollution to the environment, noise pollution in Gainesville and cause neighborhoods to be unsafe (related to interviewees, who value low traffic residential areas), cyclists do not value environmental protection as significantly more important than car commuters.

Thus, to answer this first research question, it can be argued that attitudes towards and perceived ability to commute by bike are a strong influence on the decision to come to campus by bike. The role of subjective, moral and descriptive norms is not clear as answers were not consistent. Felt responsibility and perception of environmental problems don't play a decisive role in the decision to commute either by bike or by car. As results from the interviews confirm, the choice to bike is most influenced by a consideration of personal benefit and costs rather than anything else. Car commuters don't dislike the idea of driving to campus, but their attitudes and perceived (dis)ability to cycle are obstructing factors. In the next section, the commuting behavior will be compared between car and bike users.

## *2. How does commuting behavior differ between car and bike users?*

Origin-destination mapping was used to get an overview of where the different commuter groups originate, what estimated and measured distances they travel, and how this relates to existing infrastructure. Previous research states that "bike commuters tend to live closer to their work than other types of commuters" (Cervero, 1996). The analysis confirmed this statement, with car commuters on average living further away from campus than bike commuters.

Car commuters and bike commuters estimated longer commutes than the measured travel distance revealed through the network analysis in section 5.2.1. Several issues were pointed out that played a role in the analysis and might have contributed to this difference. Nevertheless, both the estimated and measured average distances show that all commuters included in the analysis threshold originate at a 'bikeable' distance from campus. Howard McDonald & Burns state that the maximum distance commuters are willing to cover by bike lies between 4 and 7 miles. All car commuters meet this requirement.

However, commuting behavior of both groups of commuters is influenced by the infrastructure and network available to them. In transportation research, the general assumption is that car commuters will take the shortest path from home to work (Heinen et al, 2010), measured in terms of distance (depending on infrastructure) or in terms of time (depending on factors such as congestion or speed limits). Bike commuting is more complex to model. Factors such as safety and comfort play a bigger role, as cyclists are more exposed physically and thus more vulnerable. This complexity shapes an alternative commuting behavior: cyclists might not choose the shortest route to campus due to safety and comfort issues. But the longer the detour to get to the destination, the less attractive bike commuting is.

Therefore, the emphasis should be on infrastructure network density for cyclists. The more fine-grained the network, the less difference there is between the network distance and the distance ‘as the crow flies’, as distances are shorter and can be bridged more easily. As commuting behavior for cyclists is shaped by a lot more factors than shortest distance only, it is important that the prerequisite of having adequate infrastructure is fulfilled. Only if this ‘basic need’ is met, commuters will start thinking about switching from car to bike, and endure additional factors such as safety, comfort and convenience, which play a relatively more important role when commuting.

The overview of bike infrastructure in Alachua County showed that while bike lanes are in place, the amount and continuity of existing infrastructure is deficient, whereas interviewees mentioned that the quality of the pavement and markings in some cases is beneath standards. Improving this helps facilitating more direct and safer commutes by bike and makes it more attractive for others to bike to campus. The current circumstances cause cyclists to behave in reaction to car traffic (e.g. bike detours, move to the sidewalk). Improving circumstances for cyclists mitigates this and makes it less of a switch for others to start cycling.

### *3. What factors influence cyclists’ daily commute to campus?*

Three in-depth interviews were held, accompanied by video footage and GPS data from the participant’s commuting trips. Participants were asked about the decision to commute by bicycle, and what they endure during their trips.

Participants mentioned ‘enjoying’ cycling is the most important reason for them to commute by bike. Speed, convenience, and the physical exercise contribute to this. Although they were mentioned, conservation motives are not the leading motives to commute by bike. The interview results thus reflect the survey results: the motivation to bike is personal benefit rather than consideration of the environment.

Again, safety was a recurring theme during the interviews, linked to available infrastructure and the behavior of other traffic participants. Interviewees indicated safety to be among the leading motives in choosing a commuting route to campus. Safety is influenced by other traffic: interviewees indicated to vary their routes according to time of the day and/or traffic load on specific sections of their trips. The behavior of other traffic participants is more important than the availability of infrastructure; low traffic, residential areas with no infrastructure is preferred over high traffic streets with bike lanes. Although interviewees indicate to be flexible in their route choice, importance is accorded to habit and repetition: some routes are more comfortable than others, and cyclists know what to expect when taking a habitual route.

Although they acknowledge that Gainesville is a pretty supportive town for cycling, interviewees confirm that ameliorations need to be made in both availability and quality of infrastructure. This relates mostly to the safety aspect of the commute. There is not one solution to dealing with missing infrastructure. Interviewees either move on the sidewalk or into traffic, causing safety hazards to themselves and others. Regarding the quality, ameliorations such as additional ground markings might improve the objective (measured) safety of the commute, but it does not contribute to the subjective (perceived) safety of commuters. The central message interviewees

seem to communicate is that they would like infrastructure to be designed and built in a more comprehensive manner, taking into account more than just car traffic. “Traffic engineering with the cyclists in mind”, as one interviewee phrases it. This relates to small adjustments, such as designing traffic-calming measures in ways that don’t obstruct the cyclists, marking the on-road bike lanes with vibrating strips for a more ‘physical’ separation from car traffic, and enable a sun-protected commute. The factors endured by bike commuters thus reflect the objections car commuters have against commuting by bike, and revolve largely around safety, infrastructure and the issues of coping with missing infrastructure and other traffic.

#### *4. What can be done to increase the attractiveness of commuting by bike and stimulate more people to commute by bicycle?*

The fourth and last research question aims at providing an overview of what can be done to increase the attractiveness of commuting by bike, and getting more people to do so. The most important results and conclusions from this research are reflected in 3 pronounced, concluding statements that attempt to reflect what was previously said, and lead up to the discussion in section 6.2;

- People decide to commute by bike above all because it offers them personal benefits. Not because they care about the environment.

Commuters decide to ride a bike because it is the quickest, most convenient, cheapest and/or most health-benefitting way to come to campus. Caring about the environment might be an additional motivation for the people already cycling, but it is unlikely others will switch to the bike with the environment as main motivator. Key to getting drivers to bike is to emphasize that it offers personal benefits rather than environmental benefits in multiple ways, and make insightful that these personal benefits outweigh those of coming to campus by car.

- Safety and convenience are crucial to the bicycle commute, and decisive factors in the choice to commute by bike or not.

The decision to bike is shaped by two trade-offs: one between benefits of cycling versus benefits of driving discussed above, and the other between benefits of cycling versus cost of cycling. The personal benefits of commuting by bike will only outweigh the costs if the commute is safe, direct, convenient, relatively cheap and/or comfortable. Choosing to ride a bike is about weighing potential benefits mentioned in the previous statement, and the ‘costs’ of cycling, such as safety hazards, physical effort (although some see physical effort as a benefit) and harsh climatic circumstances. Not only is it important to give commuters insight in the benefits of cycling, but they have to experience these benefits themselves and come to the conclusion that it outweighs the costs.

- Car commuters are not negative towards the idea of cycling to campus. They are obstructed by both the (deficiency of) available infrastructure where they live, and a lack of confidence in their own cycling experience and skills amongst other traffic.

Lower the bar to commute by bike. Strategic analysis of where potential cyclists live, and analysis of the routes through which they are able to bike to campus fast and efficiently, should lead to the construction of adequate and continuous bike infrastructure. Getting people to bike is about enabling and encouraging them. Adequate infrastructure on strategic corridors, where cyclists can have a comfortable commute protected from other traffic and climatic conditions, is the ideal scenario in a situation of low governmental budgets. Education on how to ride

a bike, and how to deal with bikes as an automobilist, are additional measures that help ‘normalize’ and ‘emancipate’ the bike as an everyday transport mode amongst other traffic.

## **6.2 Discussion**

This research attempted to formulate answers to the question what changes can be made to increase bike-use for commuting to and from University of Florida campus in Gainesville, FL. The research findings relate fairly well to the existing literature and theory, while providing clues on what can be changed in practical terms.

The introduction to this research stated the benefits of cycling over motorized transport in general. These benefits are gaining acclaim, and the modal share for bicycle commuting in the United States is on the rise (Swanson, 2012). Still, the percentage of people that bike to work is marginal. While a lot of research has already been done and is currently being conducted on this topic, more insight is still needed on the motivations and obstructions to commute by bike, in order to build more bike-favoring environments and realize substantive modal shifts. This research aimed at contributing to this body of knowledge by performing case study research: subject of study is a specific use of the bike (commuting to University of Florida campus) in a geographically delimited area (Gainesville). University of Florida campus accounts for an important share in overall bicycle commuting in Gainesville, and the majority of the trips by bike in Gainesville are done to and from campus (Alachua County MTPO, 2001a). It thus makes sense to focus on commuting to UF campus to gain insights related to the specific context of UF and Gainesville, in order to come to recommendations on what changes can be made in this specific context, while these outcomes may translate to general implications and solutions applicable to a wider context.

Early development and adoption of cycling policies have led the City of Gainesville to have some of the highest levels of cycling activity in the state of Florida, and a strong reputation across the U.S. as being a bicycle-friendly community. The Alachua Countywide Bicycle Master Plan established in 2001 identified public expectations regarding cycling facilities through the use of a public ranking. The development of on-road bicycle infrastructure was considered most important, followed by off-road (trail-) infrastructure, the improvement of safety for cyclists, and the realization of a modal shift. One of the starting points for this bicycle master plan was the realization that existing cycling conditions in Alachua County do not fully meet the needs of its residents or visitors, and that many of the major roadway corridors into campus currently lack bicycle facilities or operate considerably below standards defined in the plan.

This research has for aim to investigate how a modal shift such as mentioned in the master plan can be realized. This is complex, as the motivations and obstructions to commute by bike are manifold and context-dependent. The findings of this research partly match, but also challenge the findings of the master plan. Safety for cyclists has been a recurring issue throughout the whole of the research, and according to the findings, improvement of safety should be the priority when considering commuting by bike in Gainesville. Safety of cyclists is dependent of the bike infrastructure available to them, and of the behavior of other traffic and the capacity of cyclists to deal with this behavior. The need for construction of (on and off-road) infrastructure is reflected by both the master plan and the research findings. However, the findings here repeat and emphasize the need for comprehensive infrastructure as a condition to this modal shift. Adding to this, research findings highlight the need for education, referring to educating traffic participants how to deal with bike traffic, and educating cyclists how to behave in traffic and provide them with enough skills to feel comfortable cycling.

Perhaps the most promising of research findings is the fact that car commuters are not anti-cycling per se. Their choice not to commute by bike is a rational decision influenced by perceived lack of quality infrastructure and riding experience and skill. These findings offer two distinct elements that can be targeted in order to reverse this decision. Complicating issue however is the fact that the decision to commute by car is not merely the result of a lack of quality bike infrastructure or cycling skills. Car commuters value the convenience, comfort, speed and time control offered by the car. More comprehensive research is needed on how to reduce the attractiveness of

commuting by car while simultaneously increasing attractiveness of cycling. Determining and quantifying the importance of the different obstructing and motivating factors offer better insights on the issues that need work in order to realize a modal shift. The impact of this research and implications for further research are discussed in the reflection.

### **6.3 Reflection**

In retrospect, two elements can be identified that impacted the quality of the findings and the ability to effectively answer the research questions: first of all, the use of a mixed-method approach and choice for the specific methods, of which the use of GPS/interviews was unknown to the researcher; second, the recruitment of participants for both the survey and GPS interviews.

The benefit of choosing a mixed-methods approach is that weaving together different research methods adds context to the data, fill gaps in knowledge, brings forth multiple truths or visions and balances the different, general and particular findings. The survey and qualitative GIS/in-depth interview techniques were chosen as their combination potentially strengthens research outcomes by combining general statements on commuting with particular statements of commuters, and findings reinforce each other by bringing nuance and context. Both research methods have their downsides; surveys offer general statements, but it is hard to determine relationships between variables. In-depth interviews offer individual perceptions, but without the feedback from others and with little context. Video footage and GPS data without the context of in-depth interviews would be subject to the interpretation of the researcher. The combined use of methods aimed at smoothing out those pitfalls. The extent to which the research questions have been answered effectively and the research aim has been fulfilled leaves the researcher optimistic that this mixed-methods approach has been effective.

As mentioned, the recruitment of research participants is a second important influence on the quality of data. As explained in section 4.3, recruitment of participants was done through snowball sampling. Snowball sampling is an example of convenience sampling, which is about including respondents that are the easiest to access. This means that the samples are selected subjectively by the researcher, rather than through random selection. Random selection allows generalization of the findings to larger populations. With the current set of data, it is not possible to generalize the data to a larger population, which is a major limitation to the research findings. However, the character and context of research, the position of the researcher in an unknown environment and the limited time available required a convenience sampling approach in order to get a sufficient amount of data. Although three very general statements on (improving circumstances for) bicycle commuting were formulated under 6.1, future research should aim at quantifying results in order to translate them to a broader context more effectively and more legitimately. Inclusion of a larger amount of survey respondents and GPS/interviews participants, with better balance between numbers of car and bike-commuters within the response group would further be valuable to the quality of research outcomes.



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# Appendix

Appendix 1 – Survey

Appendix 2 – Survey - Protocol for Review

Appendix 3 – Survey – IRB Approval forms

Appendix 4 – Video mapping (VM) exercise

Appendix 5 – VM interview guide

Appendix 6 – VM Protocol for Review

Appendix 7 – VM IRB Approval forms

Appendix 8 – Paired samples t-test results

Appendix 9 - Multiple linear regressions results

Appendix 10 – Origin-destination GIS Analysis

Appendix 11 – Interview transcripts 1 t/m 3

Appendix 12 – Interview codebook

Appendix 13 – Interview quote boxes

## Appendix 1 - Survey

### Commuting to University of Florida campus by bicycle

Thank you very much for your participation!

This survey is part of a graduate research on commuting to the University of Florida campus by bicycle. My name is Paul Plazier, I am a short-term visiting scholar at UF's College of Design, Construction and Planning, coming from University of Groningen in the Netherlands. This survey is part of the data collection for my master's thesis. The thesis research consists of two phases: this survey, investigating commuting mode-choice, and follow-up in-depth interviews investigating the actual commute to and from UF campus by bicycle.

The survey consists of a series of regular questions, and a mapping question where you will be asked to roughly indicate your area of origin and destination when commuting to campus. Results will be compiled on a 0.5 mile scale to guarantee anonymity. Your identity will be kept confidential throughout the survey and will not be revealed in the final manuscript. There are no anticipated risks, compensation or other direct benefits to you as a participant in this survey. You are free to withdraw your consent to participate and may discontinue your participation in the survey at any time without consequence.

Don't hesitate to contact me with comments or further questions at (352) 278-3993 or [p.a.plazier@gmail.com](mailto:p.a.plazier@gmail.com). Questions or concerns about your rights as a research participant may be directed to the IRBo2 office, University of Florida, Box 112250, Gainesville, FL 32611; (352) 392-0433. This research is supervised by Professor Chris Silver, dean of the College of Design, Construction and Planning. By signing this form below, you give me permission to report your responses anonymously in the final manuscript.

If you wish to receive a copy of the final thesis document as submitted to the instructor, you may indicate this below. Thank you again for your participation!

Paul Plazier

Phone: +1 (352) 278-3993

E-mail: [p.a.plazier@gmail.com](mailto:p.a.plazier@gmail.com)

I have read the procedure described above for the commuting mode choice survey. I voluntarily agree to participate in this survey.

Signature of participant:

Date:

I would like to receive a copy of the final manuscript submitted to the instructor: YES / NO

E-mail address:

[Start of the survey]

Please fill in the whole questionnaire regardless of your commuting mode (bike or car).

**Age:**

**Gender:**

- ☐ Male  
☐ Female

**What is your position at University of Florida?**

- ☐ Student  
☐ Faculty  
☐ Staff  
☐ Other: \_\_\_\_\_

**Do you have any form of physical disability?**

- ☐ Yes  
☐ No

**Please indicate the number of times you practiced the following physical activities in the last 12 months.**

	None	Less than once a month	Once a month	Less than once a week	Once a week	More than once a week	4 to 5 times a week	6 times a week or more
Walking for pleasure (you should not include walking as a means of transportation)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cycling for pleasure (you should not include cycling as a means of transportation)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sports (any form: running, swimming, tennis, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**What is the distance between home and your destination on University of Florida campus?**

Please *estimate* the distance, in miles (for example '1.5')

.....

**Which mode of transportation do you use most of the time when commuting to and from University of Florida campus?**

- ☐ Car
- ☐ Bicycle

**On average, how many days a week do you commute to UF campus using this mode of transport?**

.....

**When using other transportation modes, how do you travel to campus?**

- ☐ By car
- ☐ By bicycle
- ☐ By bus
- ☐ Walking
- ☐ Other: \_\_\_\_\_

**How important is each of the following aspects to you when choosing a transportation mode to and from campus?**

	Completely unimportant	Unimportant	Neither unimportant nor important	Important	Extremely important
That it is convenient to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That it is quick to travel to campus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That it is comfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That it is cheap to travel to campus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That I can have a good control over my time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



**“If I drive to campus with a car...”**

	Strongly disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
It is very convenient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is relatively quick	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is comfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is relatively cheap	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can have a good control over my time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**"If I cycle to campus..."**

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
It is very convenient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is relatively quick	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is comfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is relatively cheap	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can have a good control over my time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**How difficult is it for you to bike to campus?**

- ☐ Very Difficult
- ☐ Difficult
- ☐ Neutral
- ☐ Easy
- ☐ Very Easy

**How much would the following factors facilitate your decision to commute to campus by bike?**

	Not at all facilitating	Not facilitating	Undecided	Facilitating	Very facilitating
Sufficient bike lanes on my itinerary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Good quality bike lanes on my itinerary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sufficient bike parking on my destination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sufficient cycling experience and skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**What else would facilitate your decision to take the bicycle to commute to and from campus?**

.....

.....

.....

**The next time that you cycle to campus, how likely will it be that the following statements are true for you?**

	Very Unlikely	Unlikely	Undecided	Likely	Very Likely
There are sufficient bike lanes on my itinerary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are good quality bike lanes on my itinerary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is sufficient bike parking on my destination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have sufficient cycling experience and skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**How many of your friends/colleagues use a bike to commute to and from campus?**

.....

Please indicate to what extent you agree or disagree with the following statements;

**“I don't like the idea of cycling to campus”**

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**“I don't like the idea of driving to campus”**

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**“Most people who are important to me would support me in using a bike to commute to and from campus”**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**"Most people who are important to me think that I should use a bike to commute to and from campus"**

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**"I feel guilty about it when I drive to campus by car"**

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**"I do not feel bad about it when I drive to campus car"**

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

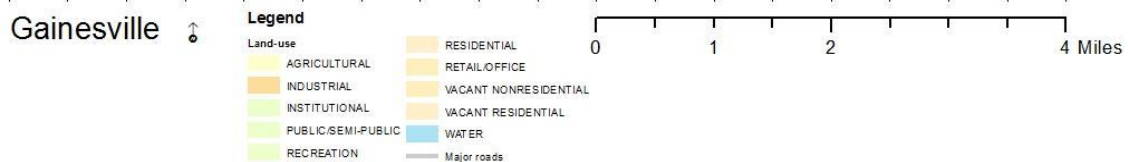
**Seven different values are listed below. Which of them are most and least important to you?**  
**Please rank the values with a number from 1 to 7, 1 being most important, 7 being least important**

- \_\_\_\_\_ Social power (the ability to influence the behavior of people)
- \_\_\_\_\_ True friendship
- \_\_\_\_\_ Quality of life
- \_\_\_\_\_ Material wealth
- \_\_\_\_\_ Protecting the environment
- \_\_\_\_\_ Authority (e.g. leadership in informal settings, parental authority)
- \_\_\_\_\_ Family security

**The following statements concern car-use. To what extent do you agree or disagree?**

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
"Car use causes serious air pollution in the world"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"Car use is a major source of noise problems in the world"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"Car use contributes to the depletion of energy sources"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"In Gainesville, air pollution caused by car use is getting serious"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"In Gainesville, car use is a major source of noise problems"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"Traffic jams are a problem in Gainesville"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"Finding a parking spot is a problem in Gainesville"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"Many neighborhoods in Gainesville are unsafe because there is too much traffic"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

[illegible]

**Thank you very much for participating in this survey!**

**Do you commute by bicycle, and would you be willing to participate in further research?**

The second part of my research focuses upon factors affecting your daily commute by bicycle to and from UF campus. Using a GPS-camera mounted on the bike handlebars, I would like to visualize your route to and from campus on one specific day, and follow this up by a short in-depth interview. This way, I hope to gain more insight in your actual cycling experience. Would you be willing to participate in this section of my research, please let me know by putting your e-mail address and/or phone number below!

.....  
.....  
.....

Paul Plazier

Phone: +1 (352) 278-3993

E-mail: p.a.plazier@gmail.com

\*\*\*\*\*

## Appendix 2 – Survey Protocol for review

UFIRB 02 – Social & Behavioral Research Protocol Submission Form			
<i>This form must be typed. Send this form and the supporting documents to IRB02, PO Box 112250, Gainesville, FL 32611. Should you have questions about completing this form, call 352-392-0433.</i>			
Title of Protocol:	Commuting to UF campus by bicycle		
Principal Investigator:	Paul Plazier		UFID #:6730-0928
Degree / Title:	Short-term visiting scholar	Mailing Address: (If on campus include PO Box address):	Email: p.a.plazier@gmail.com
Department:	College of Design, Construction and Planning	920 SW 6 <sup>th</sup> Street, apt. 313. Gainesville, FL 32601	Telephone #: (352) 278-3993
Co-Investigator(s):	None	UFID#: -	Email: -
Supervisor (If PI is student):		UFID#:	
Degree / Title:		Mailing Address: (If on campus include PO Box address):	Email :
Department:			Telephone #:
Date of Proposed Research:	February 27, 2014 – May 1, 2014		
Source of Funding (A copy of the grant proposal must be submitted with this protocol if funding is involved):	None		

**Scientific Purpose of the Study:** The purpose of the study is to compare car and bike user norms and attitudes toward bicycle commuting to University of Florida campus as well as their actual behavior, to assess how the decision to bike or drive a car to campus comes to be. The outcomes can provide leads on potential changes to be made to increase attractiveness of bicycle commuting in Gainesville, FL.

**Describe the Research Methodology in Non-Technical Language:** A survey will be conducted asking respondents about their attitudes, norms, and behavior concerning commuting by bike and by car in Gainesville. Two groups of respondents will be included: car-commuters and bicycle-commuters to UF campus, in order to investigate whether a difference exists in their attitudes, norms and behavior regarding commuting by bicycle. The survey is based upon an extended version of the theory of planned behavior. Questions concerning attitudes, norms and behavior might clarify how the decision to commute by a certain mode comes to be, and how to alter these constituents in order to bring change to the decision-making process, getting more people to commute by bicycle.

To start the survey, participants will be asked their age, gender, position at University of Florida, if they suffer of a physical disability, and about the number of times a week/month they practiced different kinds of physical activities in the past 12 months. Then, they will be asked to estimate the distance between their home and destination on UF campus in miles, asked about their prime mode of transportation, their second-choice mode of transportation, and what factors they consider important when commuting (cost, convenience, speed, comfort). They will be asked to what extent these factors influence a potential commute by bike or by car, and how difficult they consider to come to campus by bicycle. They will be asked some questions about their attitude towards bicycle commuting and towards car commuting. Then, they will be asked to rank the value of "environmental protection" amongst 6 other values. They will be asked to answer to some statements on car-use and perception on associated air-pollution, noise-pollution, depletion of energy sources, traffic jams, parking problems, and safety, and the extent to which they feel responsible or not when commuting by car. Finally, a map has been included of Gainesville metropolitan area and UF campus in the center of it. They are asked to pinpoint on the map their commuting origin and commuting destination on UF campus. The map is overlaid by a grid, squares representing areas of 0.5 by 0.5 miles each. This way, results will be compiled on a 0.5x0.5 miles level, to protect respondents anonymity.

**Describe Potential Benefits:** No direct benefits to the research participant. The resulting document may offer leads on what to change to increase the attractiveness of bicycle commuting in Gainesville. The long-term benefits of this research may thus be improvements in cycling infrastructure or better education of cyclists and automobilist, to make the commute by bicycle more safe, comfortable and convenient.

**Describe Potential Risks:** No more than minimal risk

**Describe How Participant(s) Will Be Recruited:** The sample is a convenience sample. Participants will be recruited through a snowball sampling methodology, where respondents of the survey will be asked to identify other potential subjects valuable for research.

<b>Maximum Number of Participants (to be approached with consent)</b>	150	<b>Age Range of Participants:</b>	18+	<b>Amount of Compensation/ course credit:</b>	None
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#### Describe the Informed Consent Process

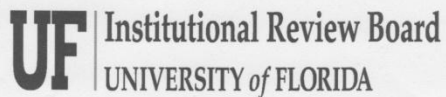
The informed consent document will be featured as the first page of the survey. In the informed consent document, the title of the project is stated, as well as the Principal Investigator's name, connection to the University of Florida and department. It is shortly described that the study involves research, and the research phases and the survey structure are detailed. It is explained how data will be kept confidential throughout the survey and in the final manuscript. It is stated that there are no anticipated risks, no compensation and no direct benefits to the survey participants. Also, it is stated that participants may withdraw their consent to participate and discontinue participation in the survey at any time without any consequence. Contact information of the Principal Investigator is included, as well as the IRB02 office in case of further questions regarding rights as a research participant. Also the contact information of the research supervisor is included. Finally, participants are asked to indicate if they wish to receive a copy of the final thesis



document as submitted to the instructor. Participants may sign the informed consent document at the end of the form, confirming that they have read the procedure described above for the commuting mode choice survey, and that they agree to participate in this survey voluntarily. They are asked to sign and write down the date.		
<b>(SIGNATURE SECTION)</b>		
<b>Principal Investigator(s) Signature:</b>		<b>Date:</b>
<b>Co-Investigator(s) Signature(s):</b>		<b>Date:</b>
<b>Supervisor's Signature (if PI is a student):</b>		<b>Date:</b>
<b>Department Chair Signature:</b>		<b>Date:</b>

\*\*\*\*\*

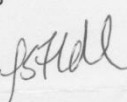
## Appendix 3 – Survey IRB Approval form



PO Box 112250  
Gainesville, FL 32611-2250  
352-392-0433 (Phone)  
352-392-9234 (Fax)  
irb2@ufl.edu

March 6, 2014

TO: Paul Plazier  
920 SW 6<sup>th</sup> Street Apt. 313  
Gainesville, FL 32601

FROM: Ira S. Fischler, PhD; Chair   
University of Florida  
Institutional Review Board 02

SUBJECT: **Exemption of Protocol #2014-U-0257**  
Commuting to UF by Bicycle

SPONSOR: None

Your protocol submission was reviewed by the IRB. The Board determined that your protocol is exempt based on the following category:

*45 CFR 46.101(b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior*

Should the nature of your study change or if you need to revise this protocol in any manner, please contact this office before implementing the changes.

IF:dl

An Equal Opportunity Institution

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## **Appendix 4 – Video mapping exercise – User guide to Contour GPS camera**

### **Bicycle commuting to University of Florida campus**

*Video-mapping your commute using a GPS camera*

RESEARCHER

Paul PLAZIER

Short-term visiting scholar

College of Design, Construction and Planning

University of Florida

Mail: [P.A.Plazier@gmail.com](mailto:P.A.Plazier@gmail.com)

Phone: (352) 278-3993

#### CONTENT OF DOCUMENT

1. Informed consent form
2. Short introduction to research
3. Instructions to using the GPS camera
4. Things to consider before video-mapping your commute

## 1. INFORMED CONSENT FORM

This video-mapping/in-depth interview exercise is part of a graduate research on commuting to the University of Florida campus by bicycle. My name is Paul Plazier, I am a short-term visiting scholar at UF's College of Design, Construction and Planning, coming from University of Groningen in the Netherlands. This research is part of the data collection for my master's thesis. The thesis research consists of two phases: a survey, investigating commuting mode-choice, and follow-up video mapping/in-depth interviews investigating the actual commute to and from UF campus by bicycle.

This guide consists of several sections. First of all, this informed consent form; second, an introduction to the purpose of this research; third, a brief explanation of how to use the GPS camera that will be handed to you to video-map your commute. Finally, this document contains a map where you will be asked to roughly indicate your area of origin and destination when commuting to campus. Results will be compiled on a 0.5 mile scale to guarantee anonymity. Also, you will be asked to read through some points of attention before starting your commute. This may help for conducting the in-depth interview.

Your identity will be kept confidential throughout the video-mapping/in-depth interview activities, and will not be revealed in the final manuscript. Please note that it is important that you don't adjust or otherwise deal with the GPS-camera while moving. The video will not be included in the final manuscript, with exception for screenshots that are considered important to the research. The GPS-data will be visualized in the final manuscript, but only between origin and destination as indicated by you on the map under section 4, thus not revealing the origin of your commute. There are no anticipated risks, compensation or other direct benefits to you as a participant in this survey. You are free to withdraw your consent to participate and may discontinue your participation in the video-mapping/in-depth interview session at any time without consequence.

Don't hesitate to contact me with comments or further questions at (352) 278-3993 or [p.a.plazier@gmail.com](mailto:p.a.plazier@gmail.com). Questions or concerns about your rights as a research participant may be directed to the IRB02 office, University of Florida, Box 112250, Gainesville, FL 32611; (352) 392-0433. This research is supervised by Professor Chris Silver, dean of the College of Design, Construction and Planning. By signing this form below, you give me permission to report your responses anonymously in the final manuscript.

If you wish to receive a copy of the final thesis document as submitted to the instructor, you may indicate this below. Thank you again for your participation!

I have read the procedure described above for the commuting mode choice survey. I voluntarily agree to participate in this survey.

Signature of participant:

Date:

I would like to receive a copy of the final manuscript submitted to the instructor: YES / NO

E-mail address:

## 2. INTRODUCTION

The Contour GPS camera is a device that is commonly used for the purpose of ‘video mapping’. It records both video and GPS-data at the same time, which offers possibilities for investigating and explaining spatial behavior of those using Contour GPS camera.

Mounting the GPS-camera on your bike handlebars, I would like to visualize your commuting route to University of Florida campus on one specific day, and follow this up by a short in-depth interview. This way, I hope to gain more insight in your actual cycling experience; how is your commute influenced by different factors? And how can these factors be altered in order to provide you with a more convenient, comfortable and safe commute to UF campus? Drawing larger lessons from this can help improving the attractiveness of bicycle commuting in Gainesville.

In the next section, section 3, I provide you with brief instructions of how to use the GPS camera.

Section 4 concerns some things I’d like you to consider prior to commuting. I first ask you to indicate your area of origin and area of destination when commuting to UF campus on the same map used in the survey. Second, I ask you to read through some things to consider before starting your itinerary: they are the factors I would like to talk to you about briefly, after you registered your commute.

### 3. USER GUIDE TO CONTOUR GPS CAMERA

#### **Before starting your commute:**

1. Attach the camera using the screw-mechanism (see picture A, below). Loosen-up the screw (don't remove screw completely), and press the camera upon the 'bullet' that is part of the mechanism attached to your bike handlebars (B). When attached properly, secure camera by turning the screw mechanism. The camera is now attached to the mechanism and fixed on your bike handlebars; you can however still twist the camera and adjust its angle.

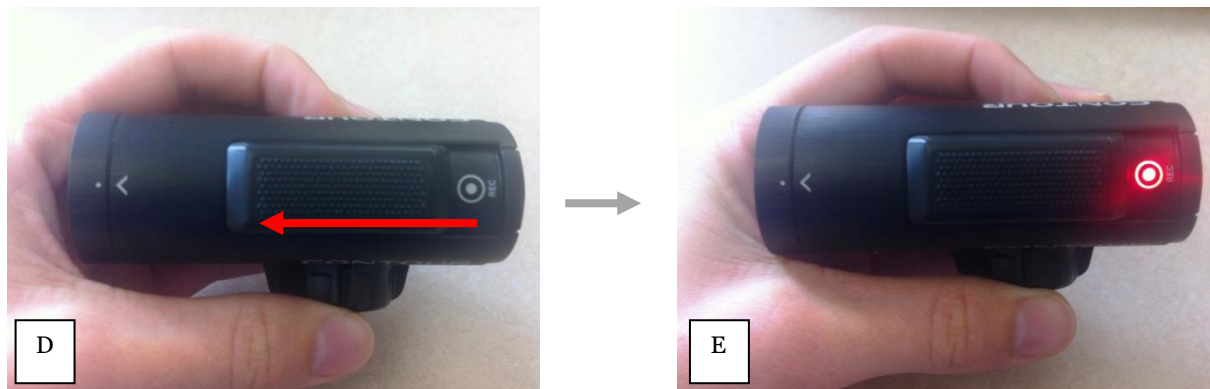


2. Make sure the camera is oriented in cycling direction. Direct the camera lens slightly towards the ground.

3. Turn the camera ON: press the on/off button shortly once (see picture C). When holding your hand in front of the camera, you will notice tiny red laser dots. You'll hear a 'beep', confirming that the camera is ON.



4. Before starting to bike, make sure the camera is RECORDING. Shift the large button on top of the camera to the front (you'll see a 'rec' logo appear, which will turn red), the camera will 'beep' once again. The camera is now recording (see pictures D&E).



5. You can start cycling. \*Please note that it is important that you don't adjust or otherwise deal with the GPS-camera while moving\*

#### **When arriving on your destination:**

6. Shift back the large button on top of the camera in order to STOP recording. Press the on/off button for approximately 5 seconds in order to turn the camera OFF. Two short 'beeps' will confirm this.

7. When parking your bike, please don't forget to take the camera with you! Loosen the screw mechanism which attaches the camera to the mechanism fixed on your bike handlebars.

#### 4. THINGS TO CONSIDER BEFORE VIDEO-MAPPING YOUR COMMUTE

After recording your commuting itinerary, I'd like to review the video and briefly talk to you about the following topics. Please have a quick read-through before actually recording your commute: keeping these issues in mind while cycling might make this research more insightful to you, and might make it easier for you to respond to issues raised during our short talk afterwards.

##### Bike infrastructure:

- Do you think there are enough bike paths, lanes or trails on your commuting itinerary to UF campus?
- If yes, is it safe, convenient and comfortable to use it to come to campus?
- What about safety, convenience and comfort when bike infrastructure is lacking? Do you cycle on or off-street, do you mix with traffic, or ride side-walks? What could be changed or improved to make your commute more safe, convenient and comfortable?

The map below represents Gainesville with the University of Florida campus in the center of it. The map is overlaid with a grid, the squares representing areas of 0.5 by 0.5 miles each. Tick two of the grid-boxes, first to indicate the area of origin of your commuting trip, and second to indicate your area of destination on University of Florida campus. Origins and destinations don't have to be exact; results will be aggregated on the 0.5 miles level, to guarantee anonymity. The GPS data retrieved from the camera will be visualized on a map in the final manuscript, but only between origin and destination, thus not revealing the origin of your commute.





Gainesville



**Legend**

Land-use	
AGRICULTURAL	RESIDENTIAL
INDUSTRIAL	RETAIL/OFFICE
INSTITUTIONAL	VACANT NONRESIDENTIAL
PUBLIC/SEMI-PUBLIC	VACANT RESIDENTIAL
RECREATION	WATER
	Major roads

0 1 2 4 Miles

\*\*\*\*\*

## Appendix 5 – VM Interview guide

### Interview guide – video mapping bicycle commuting to University of Florida campus

---

#### *General background*

---

- Respondent no.:
- Age:
- Gender:
- Position at University of Florida

#### *Opening questions*

---

- Why do you choose to commute to University of Florida campus by bike?  
Probe: convenience, cost, speed, health, etc.
- How long have you been commuting to and from University of Florida campus?  
Probe: Since the time studying/working? Or commuting mode shift? What reason?
- How often per week do you commute to University of Florida campus?  
Probe: everyday o/t week? Dependent on other factors? Which ones?
- When using other modes of transport, what modes do you use? Why?  
Probe: Weather? Convenience? Laziness?

#### *Before visualizing video (general)*

---

- Do you deviate from the shortest route to make use of cycling infrastructure?  
Probe: different itinerary to use bike path/lane/trail
  - If so, why do you deviate?  
Probe: comfort and convenience, safety
  - Was there anything special happening during this specific commuting trip that doesn't happen 'normally'/ otherwise?  
Probe: Any specific (dangerous) situations, extreme weather, route delay, etc.
-

### *Urban form*

When using bike infrastructure (cycle paths, lanes, trails)

- Would you say you are satisfied with the amount of bicycle paths or lanes along your commuting route in general?

Probe:

- Do you feel there is room for improvement, i.e. new sections to be built?

Probe: specific sections along itinerary

- What specific sections along your commute could be improved in order to ease your commute by bike? And how?

Probe:

- Would you say you are satisfied with the quality of bicycle paths or lanes along your commuting route?

Probe:

- Do you feel there is room for improvement, i.e. quality improvement?

Probe: better lining & demarcation, surfacing, visibility for & separation from other traffic ..)

- What specific sections along your commute could be improved in order to ease your commute by bike?

When no bike infrastructure available (cycle paths, lanes, trails)

- How do you cope with missing infrastructure

Probe: ride on-street, ride off-street

- What implications does missing infrastructure have for safety? Convenience? Comfort? Speed?

Probe: less safe? Mix with other transport modes, pedestrians, etc.

### *Mixed traffic*

Cycling amongst traffic, encounters with other traffic

- How are the following elements experienced during the trajectory?

- Mixing with traffic and associated safety issues

- Congestion

- Noise and air pollution

### *Safety*

- How safe do you feel riding a bike along your commuting route?
- Are there specific areas / sections / moments where you feel threatened? What poses this threat?  
Probe: other traffic / restricted visibility / lacking physical or perceived protection
- According to you, what could be improved in order to improve your feeling of safety?
- How do these elements influence convenience, speed, or comfort of commuting to UF campus?

### *Closing questions*

---

- Do you have additional (general) remarks about your commute to or from UF campus? Or on cycling in Gainesville in general?

\*\*\*\*\*

## Appendix 6 – VM Protocol for review

UFIRB 02 – Social & Behavioral Research			
Protocol Submission Form			
<i>This form must be typed. Send this form and the supporting documents to IRB02, PO Box 112250, Gainesville, FL 32611. Should you have questions about completing this form, call 352-392-0433.</i>			
Title of Protocol:	Commuting to UF campus by bicycle		
Principal Investigator:	Paul Plazier		UFID #:6730-0928
Degree / Title:	Short-term visiting scholar	Mailing Address: (If on campus include PO Box address):  920 SW 6 <sup>th</sup> Street, apt. 313. Gainesville, FL 32601	Email: p.a.plazier@gmail.com
Department:	College of Design, Construction and Planning		Telephone #: (352) 278-3993
Co-Investigator(s):	None	UFID#: -	Email: -
Supervisor (If PI is student):		UFID#:	
Degree / Title:		Mailing Address: (If on campus include PO Box address):	Email :
Department:			Telephone #:
Date of Proposed Research:	February 27, 2014 – May 1, 2014		
Source of Funding (A copy of the grant proposal must be submitted with this protocol if funding is involved):		None	

**Scientific Purpose of the Study:** The purpose of the study is to compare car and bike user norms and attitudes toward bicycle commuting to University of Florida campus as well as their actual behavior, to assess how the decision to bike or drive a car to campus comes to be. The outcomes can provide leads on potential changes to be made to increase attractiveness of bicycle commuting in Gainesville, FL.

**Describe the Research Methodology in Non-Technical Language:** This video-mapping interview is part of a broader research on commuting to UF campus by bike. Previously, a survey was conducted which represented the first section of research, where car and bike user norms and attitudes toward bicycle commuting to UF campus was investigated. (This survey was approved by UF IRB 02, protocol #2014-U-0257, reviewed on 03/05/2014). This section represents the second phase of the research, and concerns the investigation of actual behavior of cyclist during his/her commuting trip. The method of video-mapping will be used in combination with a short follow-up in-depth interview. For the video mapping process, participants will be asked to carry a small GPS-camera fixed on their bike-handlebars during one commuting trip to University of Florida campus. The camera, directed towards the road ahead, will register video material of the trip: the road ahead, the environment, other traffic, and the route biked. Simultaneously, the camera will register the route through GPS signal, allowing to visualize the commuting trip both on video and on a digital map once connected with a computer. The purpose of this act is to 'video-map' the commuting trip of the participant; during a short in-depth interview planned after the recording session, researcher and participant will be reviewing the video and some specific questions will be asked on participants commuting trip and behavior. The participants will be asked whether they are okay with the researcher recording the interview on tape for full transcription. If not, the researcher will take notes on paper. To start off the interview, some general questions will be asked: why does the participant choose to commute to UF campus by bike, for how long has the participant done so, how often per week does the participant use the bike, and what other transport modes does the participant use when not commuting by bike. Before video visualization, participant will be asked the following questions: do you deviate from the shortest route to make use of cycling infrastructure? If so, why? And finally, was there anything special/unusual happening during this specific commuting trip that doesn't happen normally/otherwise? Then, researcher and research participant will both visualize the video. During visualization, participant will be asked to give his opinion on the quantity and quality of cycling infrastructure used (if any exists along the route). The participant will be asked where he feels there is room for improvement, and what should be improved. If applicable, the participant will be asked how he/she copes with missing infrastructure, and what implications this has for his/her trip safety, convenience, comfort and speed. Some further questions will be asked on his/her behavior when cycling amongst traffic, and experienced safety issues, congestion, noise and air pollution. To finish off the interview, the participant will be asked if he/she has any additional remarks on commuting to or from UF campus.

Participants to the video-mapping interview are recruited through the survey conducted earlier. At the end of the survey, they were asked to leave their e-mail address if interested in participating in further research. These participants will be contacted asking them whether they still are willing to participate in the research. If so, they will be sent the GPS\_camera\_user\_guide document (attached to this IRB protocol). The user guide provides a short description of what is expected from the participant. It contains the informed consent form, acknowledging that participation is voluntary, and that participant has the ability to drop-out of the research at any moment. It contains the description of how to use the GPS camera provided; it contains a map of Gainesville metropolitan area and UF campus in the center of it. They are asked to pinpoint on the map their commuting origin and commuting destination on UF campus. The map is overlaid by a grid, squares representing areas of 0.5 by 0.5 miles each. This way, results will be compiled on a 0.5x0.5 miles level, to protect respondents anonymity. Finally, the GPS camera user guide contains a section asking the participant to consider some aspects of their commute before recording their trip and taking the in-depth interview: quantity and quality of infrastructure, health, safety and convenience issues, and potential for improvement.

**Describe Potential Benefits:** No direct benefits to the research participant. The resulting document may offer leads on what to change to increase the attractiveness of bicycle commuting in Gainesville. The long-term benefits of this research may thus be improvements in cycling infrastructure or better education of cyclists and automobilist, to make the commute by bicycle more safe, comfortable and convenient.

**Describe Potential Risks:** No more than minimal risk

**Describe How Participant(s) Will Be Recruited:** Participants will be recruited through the survey conducted earlier. They were asked whether they would be interested in participating in further research, and if so, to leave their e-mail address behind. They will be contacted, asked if they are still willing to participate in further research. If so, they will be sent or handed over the GPS camera user guide.

<b>Maximum Number of Participants (to be approached with consent)</b>	15	<b>Age Range of Participants:</b>	18+	<b>Amount of Compensation/ course credit:</b>	None
<b>Describe the Informed Consent Process</b> <p>The informed consent document will be featured on the first page of the GPS Camera user guide, sent to the participants that agreed to participate in further research when completing the survey that represents the first phase of this research.. In the informed consent document, the title of the project is stated, as well as the Principal Investigator's name, connection to the University of Florida and department. It is shortly described that the study involves research, and the research phases and the survey structure are detailed. It is explained how data will be kept confidential throughout the survey and in the final manuscript. It is stated that there are no anticipated risks, no compensation and no direct benefits to the survey participants. Also, it is stated that participants may withdraw their consent to participate and discontinue participation in the survey at any time without any consequence. Contact information of the Principal Investigator is included, as well as the IRB02 office in case of further questions regarding rights as a research participant. Also the contact information of the research supervisor is included. Finally, participants are asked to indicate if they wish to receive a copy of the final thesis document as submitted to the instructor. Participants may sign the informed consent document at the end of the form, confirming that they have read the procedure described above for the commuting mode choice survey, and that they agree to participate in this survey voluntarily. They are asked to sign and write down the date.</p>					
<b>(SIGNATURE SECTION)</b>					
<b>Principal Investigator(s) Signature:</b>					<b>Date:</b>
<b>Co-Investigator(s) Signature(s):</b>					<b>Date:</b>
<b>Supervisor's Signature (if PI is a student):</b>					<b>Date:</b>
<b>Department Chair Signature:</b>					<b>Date:</b>

\*\*\*\*\*

## Appendix 7 – Video mapping IRB Approval forms

**UF** Institutional Review Board  
UNIVERSITY of FLORIDA

PO Box 112250  
Gainesville, FL 32611-2250  
352-392-0433 (Phone)  
352-392-9234 (Fax)  
irb2@ufl.edu

DATE: April 15, 2014

TO: Paul Plazier  
c/o Christopher Silver  
PO Box 115701  
Campus

FROM: Ira S. Fischler, PhD; Chair *ISF*  
University of Florida  
Institutional Review Board

SUBJECT: **Revision of Protocol #2014-U-0257**  
*Commuting to UF Campus by Bicycle*

SPONSOR: None

The request to revise the above referenced protocol has been reviewed and approved. The revision has not changed the status, as the study remains exempt in accordance with the following:

*45 CFR 46.101(b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior*

Should any further revisions be made to the protocol, the Board must review prior to implementation.

IF:dl

- *Added video-mapping and interview section*
- *Revised informed consent*

An Equal Opportunity Institution

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## Appendix 8 – Paired samples t-test results

General information			Car mean	Cycle mean	P-value
	Please indicate the number of times you practiced physical activities in last 12 months				
		Walking for pleasure	4.59	4.76	0.864
		Cycling for pleasure	2.48	4.47	<0.005***
		Sports	5.21	4.82	0.384
	What is the distance between home and destination on University of Florida campus?		4.57	2.67	<0.005***
		How many days a week do you commute to UF using this mode of transport? (bike/car)	4.31	4.25	0.825
Elements in the Theory of Planned Behavior					
ATTITUDES					
Evaluation of behavioral beliefs					
	Important when commuting	Convenience	4.52	4.53	0.904
		Speed	4.41	4.47	0.701
		Comfort	3.86	3.85	0.954
		Cost	3.72	4.23	0.005**
		Time control	4.45	4.58	0.310
Subjective probability of behavioral beliefs					
	If I drive to campus with a car	It is very convenient	4.21	2.23	<0.005***
		It is relatively quick	4.28	2.93	<0.005***
		It is comfortable	4.48	3.72	<0.005***
		It is relatively cheap	3	2.1	<0.005***
		I have good control over my time	4.45	2.65	<0.005***
	If I cycle to campus	It is very convenient	2.79	4.57	<0.005***
		It is relatively quick	2.97	4.28	<0.005***
		It is comfortable	2.59	3.87	<0.005***
		It is relatively cheap	4.38	4.8	0.110
		I have good control over my time	3.55	4.65	<0.005***
Attitudes towards cycle/car commuting					
	I don't like the idea of cycling to campus		2.34	1.33	<0.005***
	I don't like the idea of driving to campus		2.66	4.12	<0.005***
SUBJECTIVE NORM					
Subjective norm					
	People important to me would support me in biking to commute to and from campus		3.79	4.52	<0.005***
	People important to me think that I should use a bike to commute to and from campus		2.72	3.47	<0.005***
PERCEIVED BEHAVIORAL CONTROL					
Perceived behavioral control					
	How difficult is it for you to bike to campus?		2.76	4.25	<0.005***
Evaluation of control beliefs					
	Factors facilitating decision to commute by bike	Sufficient bike lanes on itinerary	3.97	4.2	0.216
		Good quality bike lanes on itinerary	4.1	4.25	0.539
		Sufficient bike parking on destination	3.66	4.17	0.037*
		Sufficient cycling experience & skills	3.69	3.97	0.232
Subjective probability of control beliefs					
	How likely is it that following is true	There are sufficient bike lanes on itinerary	2.83	3.47	0.035*
		There are good quality bike lanes on itinerary	2.55	3.37	0.007**
		There's sufficient bike parking on destination	3.52	4.15	0.019*
		I have sufficient cycling experience & skills	3.41	4.58	<0.005***
MORAL NORM					
	I feel guilty about it when I drive to campus by car		2.62	3.47	<0.005***
	I do not feel bad about it when I drive to campus by car		3.45	2.47	<0.005***
DESCRIPTIVE NORM					
	How many of your friends/colleagues use a bike to commute to/from campus		6.38	7.64	0.515
ENVIRONMENT					
Value rank					
	Importance of values. Rank the values, 1 being most important, 7 being least important				
		Social power	5.55	4.80	<0.05*
		True friendship	2.90	2.82	0.824
		Quality of life	2.38	2.43	0.894
		Material wealth	5.31	5.58	0.424
		Protecting the environment	4.59	3.92	0.094
		Authority	5.66	5.37	0.376
		Family security	2.31	2.67	0.382

Problem awareness				
	<i>Car use causes serious air pollution in the world</i>	<b>4.21</b>	<b>4.52</b>	<b>0.041*</b>
	<i>Car use is a major source of noise problems in the world</i>	<b>3.83</b>	<b>3.97</b>	<b>0.533</b>
	<i>Car use contributes to the depletion of energy sources</i>	<b>4.38</b>	<b>4.50</b>	<b>0.541</b>
	<i>In Gainesville, air pollution caused by car use is getting serious</i>	<b>2.79</b>	<b>2.98</b>	<b>0.287</b>
	<i>In Gainesville, car use is a major source of noise problems</i>	<b>2.97</b>	<b>3.57</b>	<b>0.016*</b>
	<i>Traffic jams are a problem in Gainesville</i>	<b>3.76</b>	<b>3.9</b>	<b>0.563</b>
	<i>Finding a parking spot is a problem in Gainesville</i>	<b>3.76</b>	<b>4.22</b>	<b>0.051</b>
	<i>Many neighborhoods in Gainesville are unsafe because of too much traffic</i>	<b>2.79</b>	<b>3.28</b>	<b>0.049*</b>
Felt responsibility				
	<i>I personally feel responsible for the problems resulting from car use when I drive</i>	<b>2.9</b>	<b>3.2</b>	<b>0.210</b>

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## Appendix 9 – Multiple linear regressions results

### Multiple regression 1

Dependent variable: "I don't like the idea of driving to campus"

Independent variables: (If I drive to campus...) "I can have good control over my time", "It is relatively cheap", "It is comfortable", "It is very convenient", "It is relatively quick"

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.559a	<b>.313</b>	.272	.974	
a Predictors: (Constant), "If I drive to campus with a car..."-I can have a good control over my time, "If I drive to campus with a car..."-It is relatively cheap, "If I drive to campus with a car..."-It is comfortable, "If I drive to campus with a car..."-It is very convenient, "If I drive to campus with a car..."-It is relatively quick					

ANOVA a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35.830	5	7.166	7.561	<b>.000b</b>
	Residual	78.664	83	.948		
	Total	114.494	88			
a Dependent Variable: "I don't like the idea of driving to campus"						
b Predictors: (Constant), "If I drive to campus with a car..."-I can have a good control over my time, "If I drive to campus with a car..."-It is relatively cheap, "If I drive to campus with a car..."-It is comfortable, "If I drive to campus with a car..."-It is very convenient, "If I drive to campus with a car..."-It is relatively quick						

Coefficients a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	5.341	.402		13.282	.000		
	If I drive to campus with a car..."-It is very convenient	-.253	.108	-.328	-2.342	<b>.022</b>	.423	2.365
	If I drive to campus with a car..."-It is relatively quick	.149	.126	.179	1.181	.241	.360	2.777
	If I drive to campus with a car..."-It is comfortable	-.145	.135	-.139	-1.078	.284	.498	2.009
	If I drive to campus with a car..."-It is relatively cheap	-.117	.109	-.115	-1.072	.287	.719	1.391
	If I drive to campus with a car..."-I can have a good control over my time	-.191	.133	-.229	-1.438	.154	.326	3.070
a Dependent Variable: "I don't like the idea of driving to campus"								

## Multiple regression 2 (including all four variables)

Dependent variable: "How difficult is it for you to bike to campus?"

Independent variables: "I have sufficient cycling experience and skills", "There are good quality bike lanes on my itinerary", "There is sufficient bike parking on my destination", "There are sufficient bike lanes on my itinerary"

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.523a	.273	.239	1.036	
a Predictors: (Constant), The next time that you cycle to campus, how likely will it be that the following statements are true for you?-I have sufficient cycling experience and skills, There are good quality bike lanes on my itinerary, There is sufficient bike parking on my destination, There are sufficient bike lanes on my itinerary					

ANOVA a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33.918	4	8.479	7.903	.000b
	Residual	90.127	84	1.073		
	Total	124.045	88			
a Dependent Variable: How difficult is it for you to bike to campus?						
b Predictors: (Constant), "I have sufficient cycling experience and skills", "There are good quality bike lanes on my itinerary", "There is sufficient bike parking on my destination", "There are sufficient bike lanes on my itinerary"						

Coefficients a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.837	.465		3.950	.000		
	-There are sufficient bike lanes on my itinerary	-.338	.152	-.383	-2.227	.029	.292	3.420
	-There are good quality bike lanes on my itinerary	.567	.151	.649	3.748	.000	.289	3.463
	-There is sufficient bike parking on my destination	-.120	.117	-.121	-1.020	.310	.616	1.623
	-I have sufficient cycling experience and skills	.414	.112	.408	3.708	.000	.714	1.401
a Dependent Variable: How difficult is it for you to bike to campus?								

## Multiple regression 2 (excluding two variables with high VIF scores)

Dependent variable: "How difficult is it for you to bike to campus?"

Dependent variables: "I have sufficient cycling experience and skills", "There are good quality bike lanes on my itinerary"

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.470a	.221	.203	1.060	
a Predictors: (Constant), The next time that you cycle to campus, how likely will it be that the following statements are true for you?-I have sufficient cycling experience and skills, The next time that you cycle to campus, how likely will it be that the following statements are true for you?-There are good quality bike lanes on my itinerary					

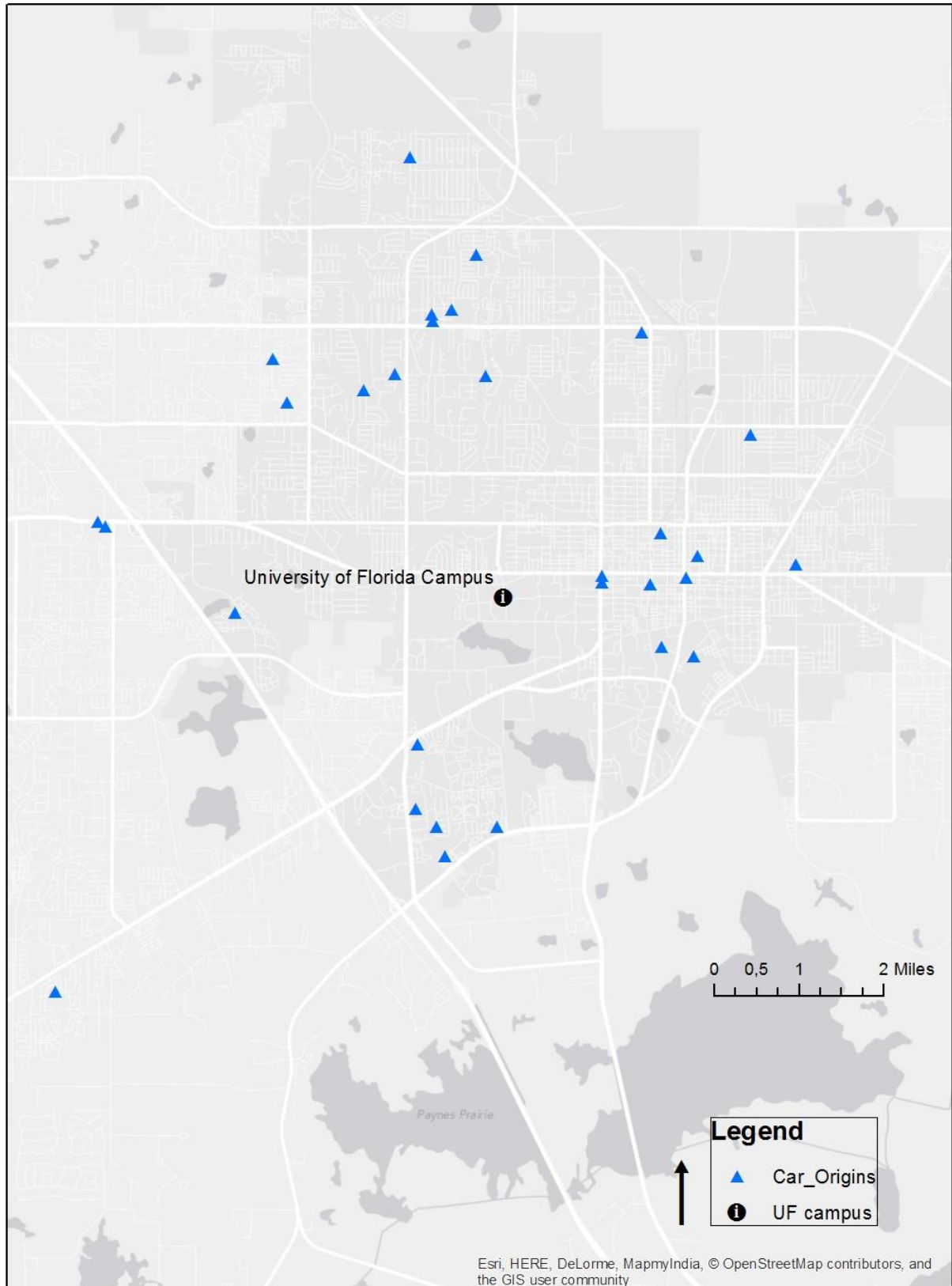
ANOVAa						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.411	2	#####	12.197	.000b
	Residual	96.634	86	1.124		
	Total	124.045	88			
a Dependent Variable: How difficult is it for you to bike to campus?						
b Predictors: (Constant), The next time that you cycle to campus, how likely will it be that the following statements are true for you?-I have sufficient cycling experience and skills, The next time that you cycle to campus, how likely will it be that the following statements are true for you?-There are good quality bike lanes on my itinerary						

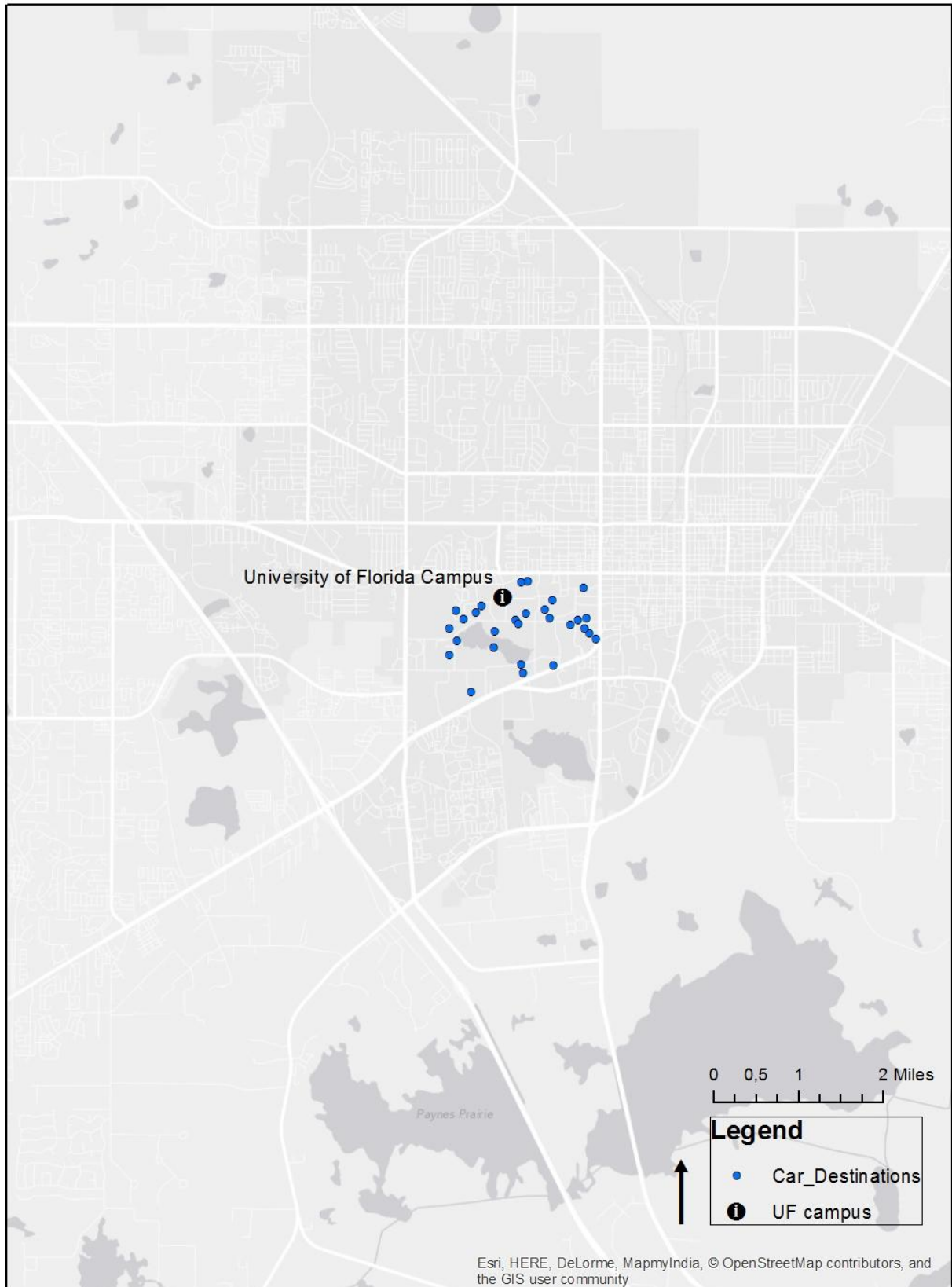
Coefficientsa								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.645	.457		3.599	.001		
	There are good quality bike lanes on my itinerary	.259	.085	.296	3.042	.003	.956	1.046
	I have sufficient cycling experience and skills	.313	.099	.308	3.169	.002	.956	1.046
a Dependent Variable: How difficult is it for you to bike to campus?								

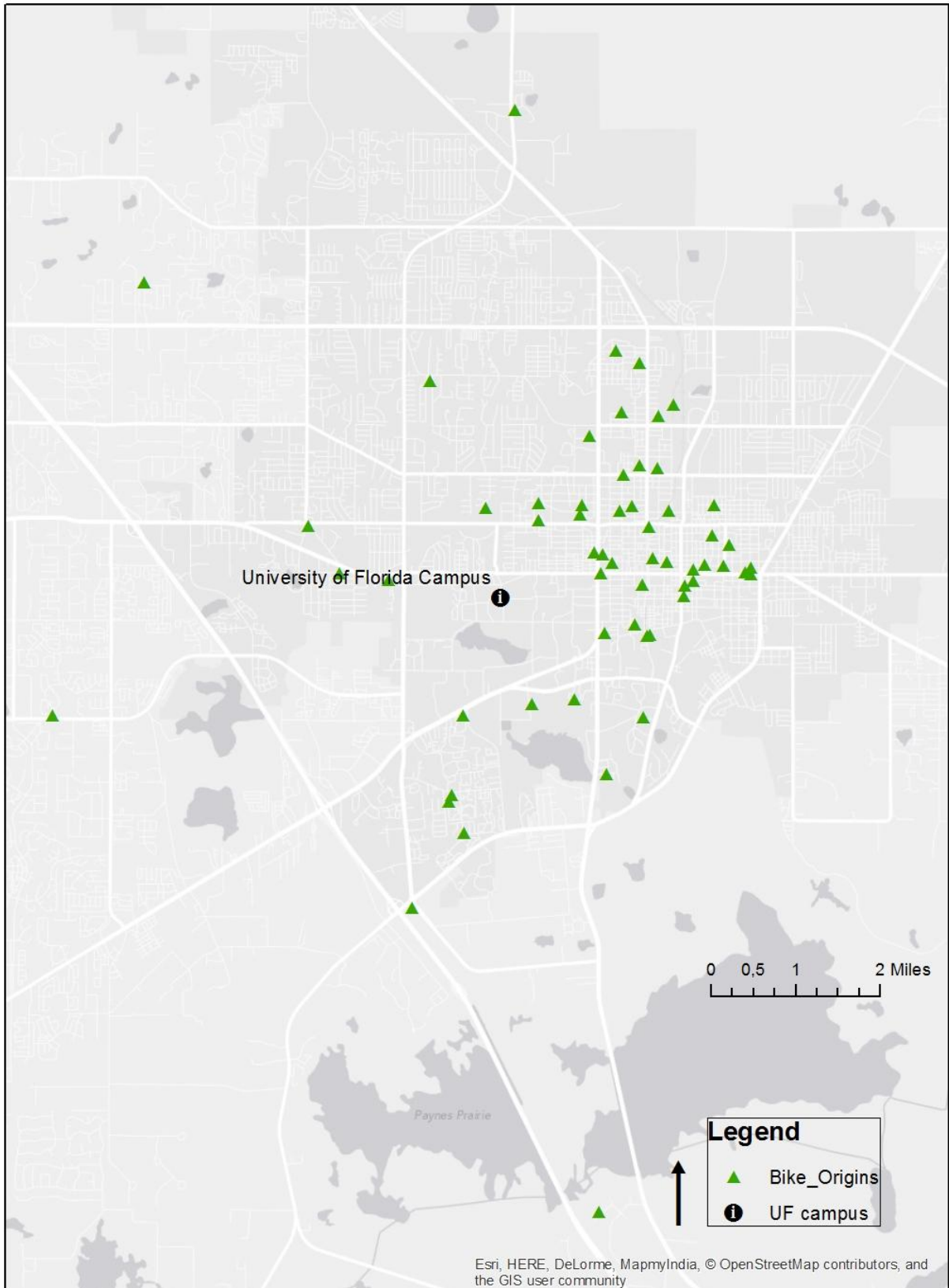
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## Appendix 10 – GIS analysis

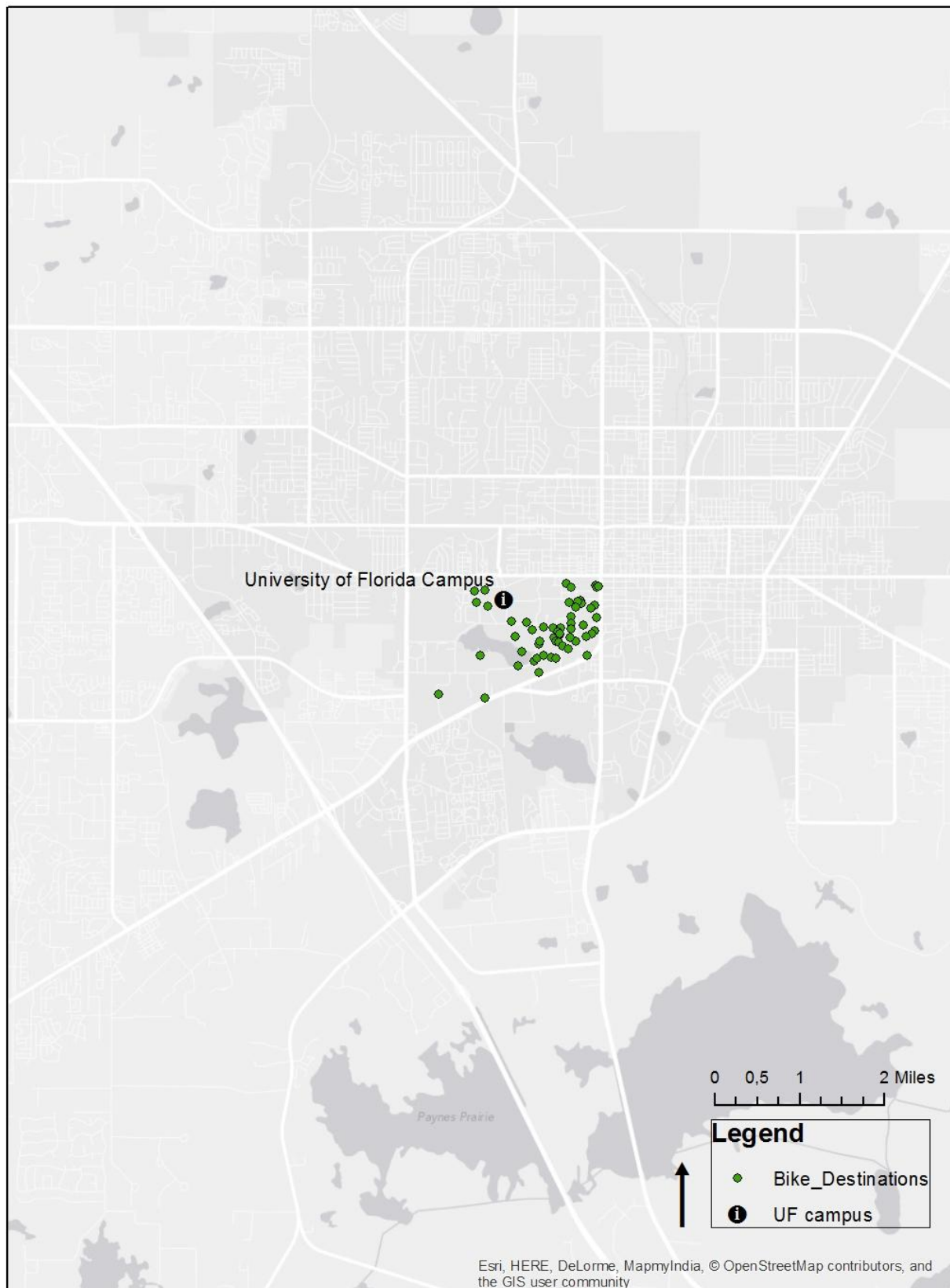
### Section 1 – visualization of car origins, car destinations, bike origins and bike destinations



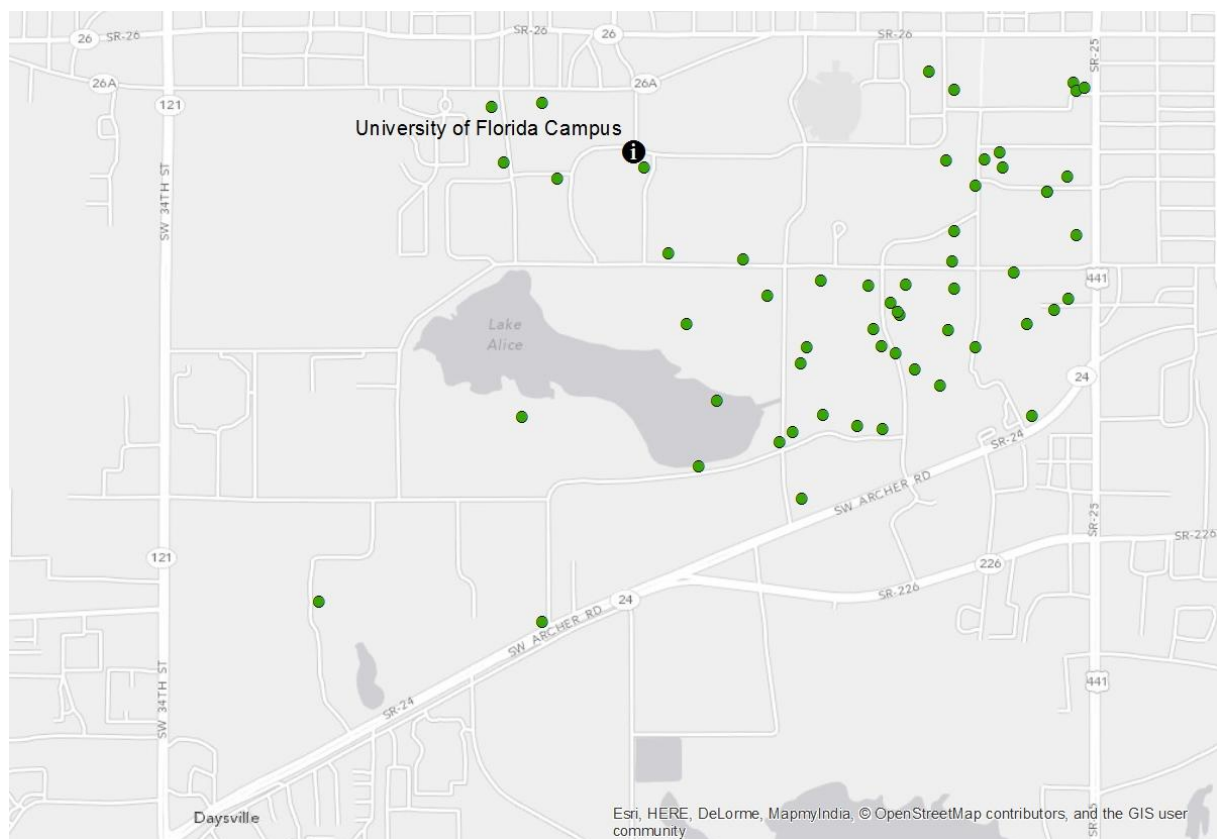




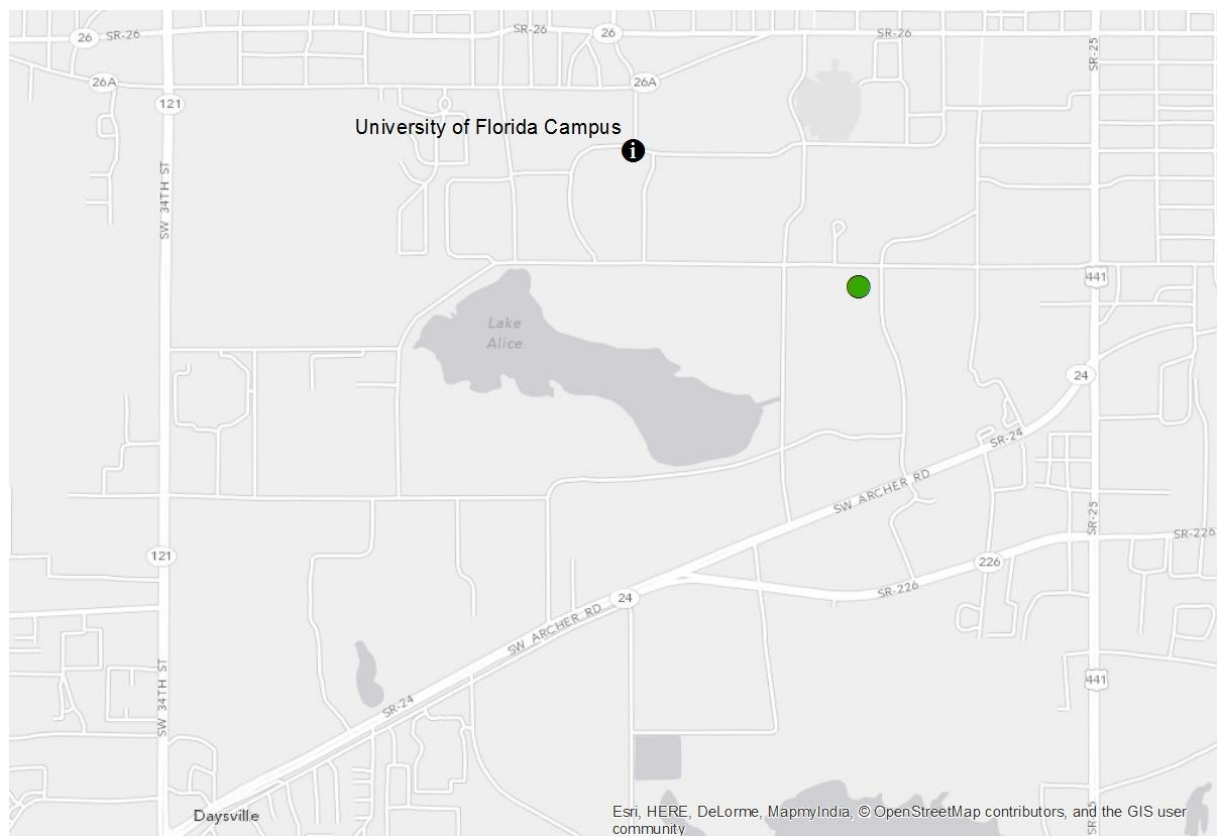


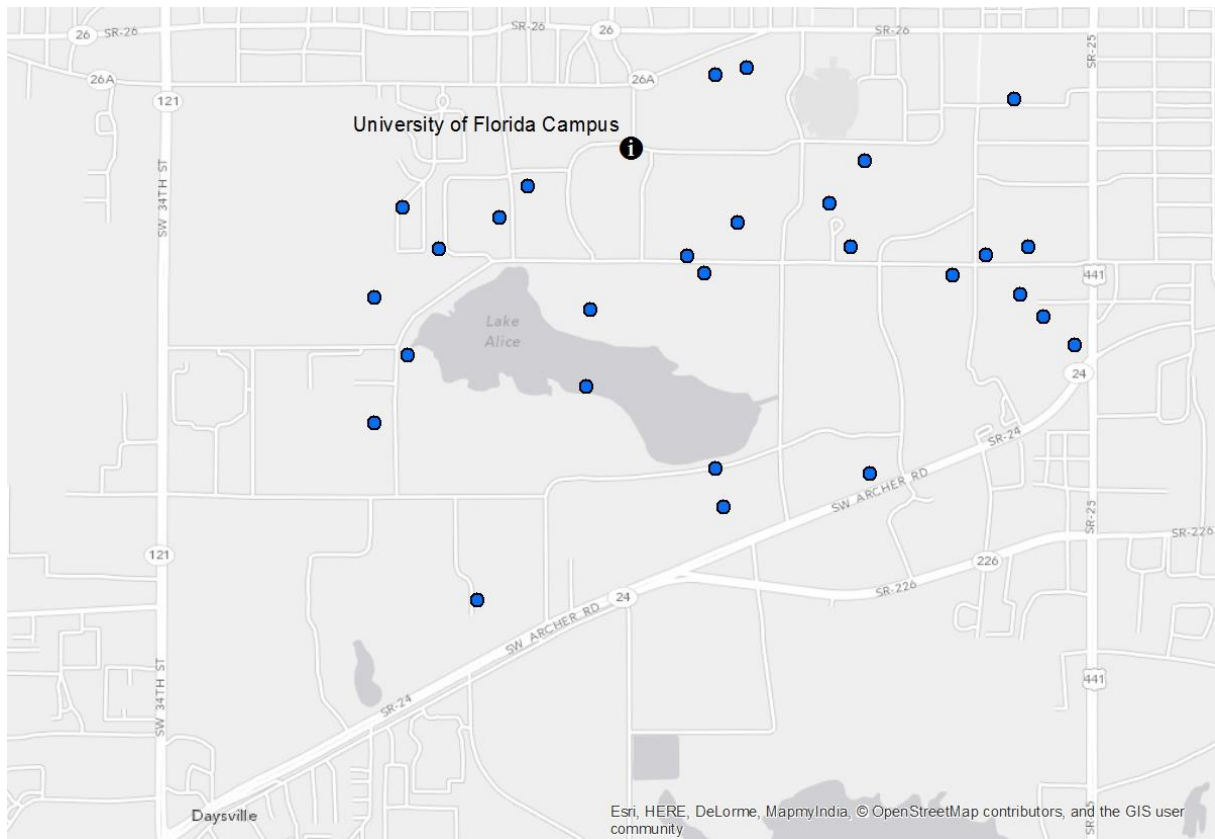


## Section 2 – Calculations of mean centers for bike destinations and car destinations

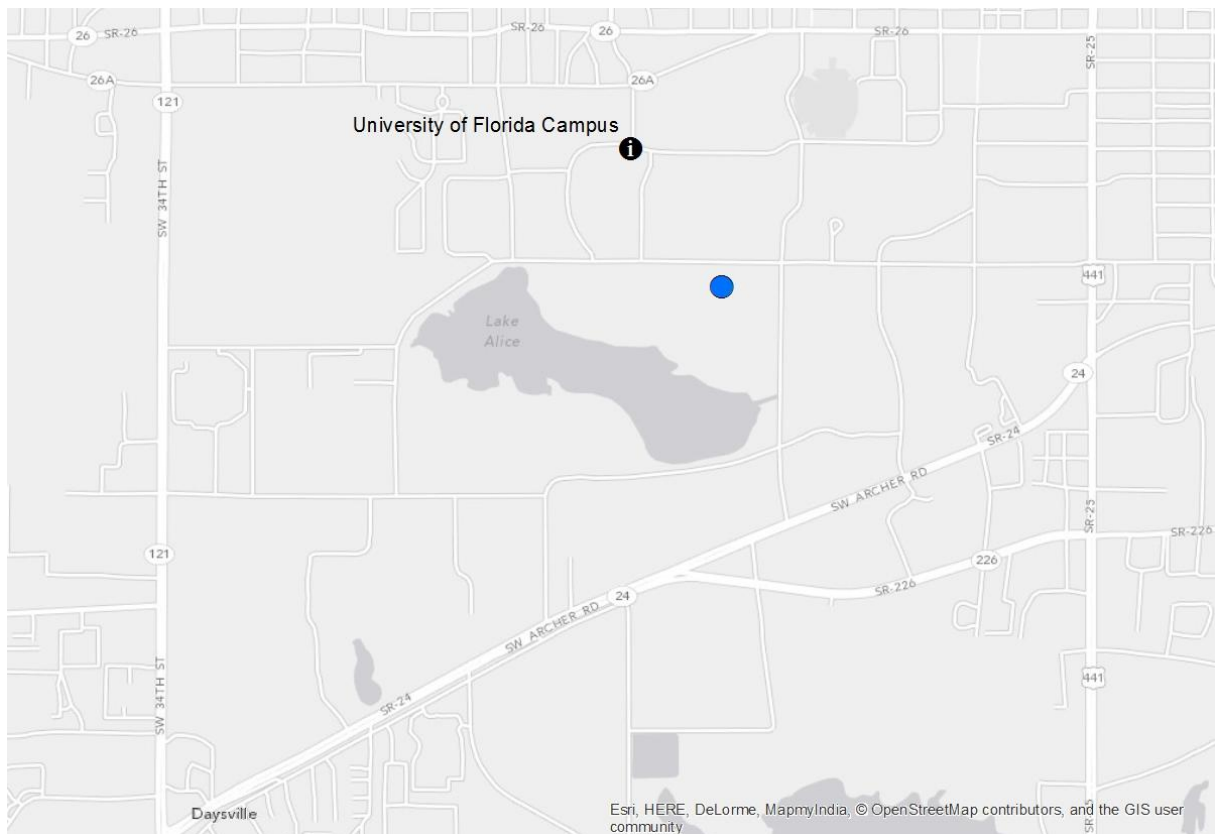


Bike destinations (above) aggregated in mean bike destination (below)



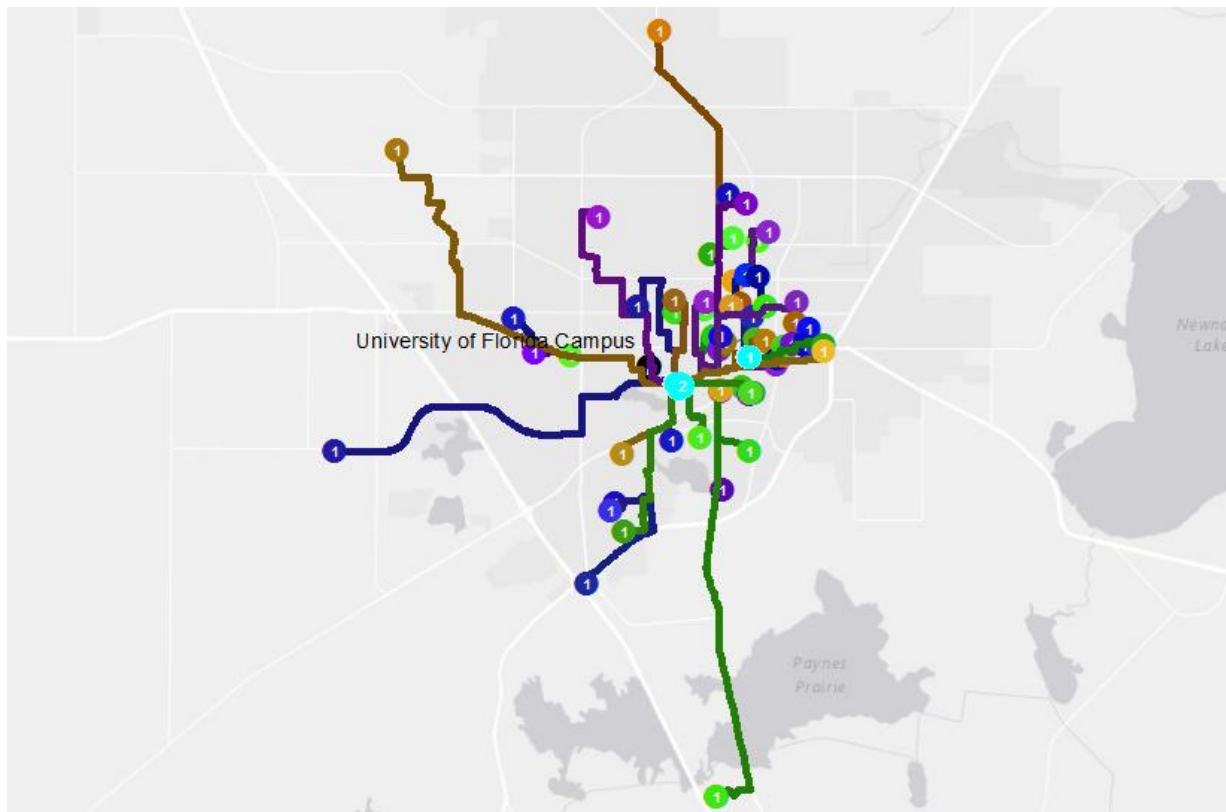


Car destinations (above) aggregated in mean car destination (below)



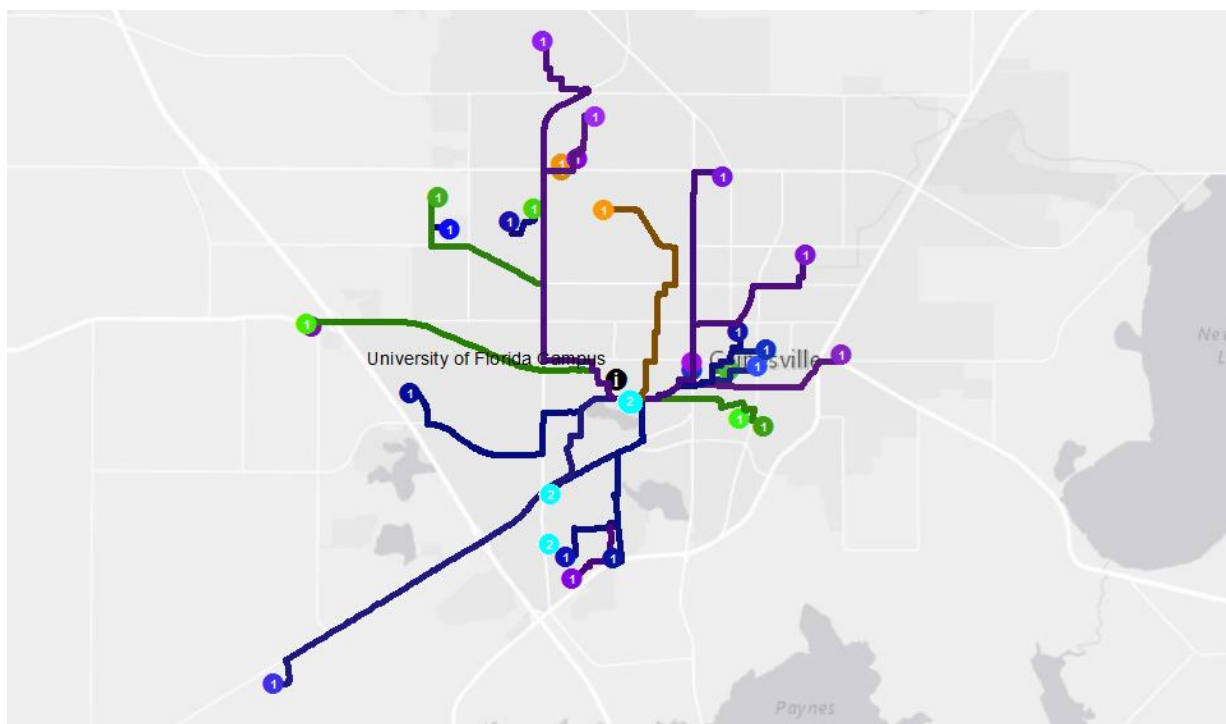
### Section 3 – Network analysis

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Above: Shortest path network analysis for bike commuters

Below: Shortest path network analysis for car commuters



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## Appendix 11 – interview transcripts 1 t/m3

### INTERVIEW TRANSCRIPT 1

*No. of interview: 1*

*Date: 16-04-2014*

*Location of interview: participant's workplace*

Notes:

Before starting the interview, the participant's consent was asked for recording the interview on tape, in order to make transcription easier and more truthful. The participant agreed to the recording of the interview

Before the start of the interview, the participant was thanked for participation in the research, video-taping the commute and participating in the interview. The participant was asked whether he had any questions.

- So, I have some general questions, and then some questions more related to your commute in particular

*Okay*

- So the first question I would like to ask you is, why do you commute to UF by bike?

*Uhm, there's several reasons I.. Now this.. Well number one is just that I love riding my bicycle.. I think that's the principle reason.*

*Yeah*

*I like the being outside, the speed, I like bikes.. in general. Just as pieces of equipment.*

*Right*

*The aesthetics.. there's a directness about them that I think is.. is good. Uhm.. the other thing is that it is the most efficient way for me to get to school. By car, as you can see, it takes me.. I can get to, from my home door to my office door in less time than I can to drive to school, park it in the garage, come down the elevator, walk five minutes, so about the time I do that, plus all of the, sort of, hassle of getting in and out the garage, the car.. parking the car in the garage, where it gets hit by people that don't pay attention with their doors.. So I.. I think that's the probably the second reason.. uhm..*

*So convenience and speed..*

*Yeah convenience and speed, and I.. I also like the fact that I'm not spending that much gas on my car.. my car gets less.. you know, I'm producing less pollution, there's less automobiles on the roads, so.. I guess, conservation issues. So number one is just, I like riding the bicycle. And number two is the convenience factor, and number three has the conservation issues.*

Right. Have you always been commuting UF campus by bike?

*About.. since my kids left home, my last child left about ten years ago*

Okay

*Before that I was driving them regularly to school, which is beyond bicycle range, and, commuting range, particularly children.. (Yeah) it is virtually impossible in a city with any greater distances.. I think if they went to a school that was a little closer, that would be easier. I see people in the neighborhood biking with, you know, children (..) in sort of bubble things, you know (..) But that has been about ten years since I.. And I lived in this house, which is downtown in the historic district, which is about fifteen minutes from school by bike, for like twenty years.*

*So about ten, ten years of regular commuting.*

And, uh, do you ever have moments that you use other commuting modes, or

*I, uh, occasionally I.. occasionally I use the bus, but (..) it's much less convenient because, in order to get the line that I need, I have to walk ten minutes. It takes me ten minutes to walk downtown, and then I wait for the bus, and that goes to the intersection of University and 13<sup>th</sup>, and then I walk to school. So literally I can walk (..) I walk rather fast, and I can get to school walking, in 45 minutes or less, and it may take me an hour if I take the bus. So, you know, its (..) It's really not that efficient*

So speed isn't a factor there

*Now I think that the bus line where I was (..) where I used to be (..) was on directly (..) there was a bus line that stopped right outside of my house (..) and it, uhm (..) I took that regularly. Before I moved downtown. (Okay) The problem with the bus lines in Gainesville is, they're just not as frequent (..) probably (..) they should be in order to do. So if you walk out, if you happen to miss the bus it could be 45 minutes before you can get another (..) 30 to 45 minutes, it depends. Uhm, so I don't do that as frequently. So I'm either riding my bike or walking if I'm (..) you know mostly the things that I have, happen where I'm located (..) I take my bike up to the supermarket, which is two blocks, or walk. So everything that I basically need (..) you know, is pretty close to my house*

At least within biking or walking distance

*Walking or bike, yeah.*

Are there specific reasons for, when you decide to take the bus, is that for example weather-related?

*Well, uhm (..) sometimes it is, you know. Sometimes, if my wife, who works on the other side of town, and really can't get there any other way, except for a car, if she takes me to work and drops me off, I'll come back.. If I lock myself out of the house.. (laughs).. which I've done frequently.. and can't get to my bike, uhh (..) I walk and take the bus.*

Okay, uhm, so I've noticed that on the video, about, I think, three-quarters of the distance you bike, there are bike lanes, actual bike lanes along car lanes.. The first part is through a residential neighborhood, which is (..) uhm, you could say, no bike lanes are needed, cause there's very low traffic..

*Yeah, yeah, now (..) traffic is light, it's slow cause it's a grid (..) people in that neighborhood generally are conscious about bicyclists..*

Right

*Uhm.. I take the (..) the two routes that I take I usually go down Main street, which is the one that you saw, the principle one with bike lanes.. There's a boulevard south (..) with (..) South 1<sup>st</sup> street, that has an island in the middle, and it's (..) a more pleasant drive, but quite frankly people drive, like, as fast as they do out on Main street, and there are bike lanes, and there's automobiles on the side.. and I frankly feel (..) safer in the middle of all of the traffic with the bike lane than I do on that street. Cause people are often they'll pay attention, they're going too fast, and there's a nursery school nearby.. and there are people driving with children, and they're (..)*

They're just not paying attention..

*(..) not paying a lot of attention.*

Would you say that in general, you tend to bike the shortest route to the UF campus, or do you deviate from the shortest route because elsewhere there's more convenient infrastructure available?

*Well I usually take the route that I (..) it is the shortest most direct one (..) but, sometimes I get bored and I just go another way.. or, there's been construction on Southwest 2<sup>nd</sup>, they're building the new, uhm, sort of the 'innovation center'.. Innovation Hub.. and there's infrastructure going on, and there are deviations from that. But that 's basically the route I follow.. It's not (..) I guess, when you're going to work, you really, you have your mind set on other things, and I like a repetitive route, you know, I know exactly what's going on (..) you know the roads (..) the conditions of them, what to expect.. so.*

During this commute, well, you indicated yourself that at a certain point there was a, uh, an automobilist, car-driver, almost running you over.

*Yeah, yeah*

Would you say that is something that happens more often?

*Uhm (..) I would say that I expect to be run over (laughs) because I assume that automobiles are really not paying attention or they don't care.. this guy (..) I was in (..) I was almost through the traffic circle, and the guy just came right in front of me.. And I (..) I had a (..) I saw him right in the corner of my eyes, so I kind of assumed that he wasn't looking (..) he was lying back in the seat, driving (..) it irritated me, so I yelled at him.. Probably shouldn't do that, cause you know, people (..) you don't know how people will react. My wife said I was an idiot also, for yelling at him. She said, you know, "what if people get out of the car and come after you".. But I say that's alright. But I would say that, on those areas where there are bike lanes and things are clearly marked.. (-22.37 to go) I would say there are incidents like that three or four times a week (Oh!) where people are not paying attention..*

Especially on the sections which are marked?

*On the traffic circles.. And people don't know how to deal with it, it's not a common phenomenon in most American cities to have traffic circles.*

The transition from bike lane and car lane to a roundabout kind of set-up..

*..yeah. And I would say in general, uh, automobilists, uh, drivers, uh, don't know what to do with the traffic circle situation.. with cars or with bicycles. And for bicycles it's complicated, you know, they either stop in the middle where everybody (..) the traffic flow is totally interrupted. Or they don't pay attention to you. It's a question of taking the right of way from you, or, not yield the right of way. In which you have to stop, get off the bike, they're stuck in the middle, you know, it's just an awkward situation.. Most of it has to deal with that. Other intersections.. also there are people that are, you know, changing lanes, making right turns, so (..) there are people that just don't pay attention.. And busses, frankly, busses are the worst.*

The busses are the worst?

*The busses are the worst. Because they drive fast, on that Southwest 2<sup>nd</sup>, they (..) most of 'em, I mean I can't prove it, but they're speeding, you know, they're going much faster, and they're larger, so there are larger wind patterns, and they tend to be right (..) because of their size, they're right on the edge of the bike lanes, uhm, I find them to be very aggressive, ironically.*

That's funny cause I (..) when I bike myself, around town, I (..) at first I thought (..) I never really paid attention to it, but the busses are the ones that drive the most, that drive all day, and they should be the ones who are most used to other traffic flows around them (..)

*Right*

(..) such as bicycles. But that is not at all..

*Well it's not been my experience, it's not like they're after you or anything, but they, you know, they're on a schedule, and, you know (..) they have to meet certain times, and.. the traffic is frustrating, they get behind, and (..) On this route, I think, uhh, when they put in those traffic circles, there was an argument about it whether it was a good idea, because it makes it very difficult for vehicles, like emergency vehicles, to kind of get around them (..) it's like, uhm (..) so and I think that that creates a lot of, say, difficulties, you know.. But in general, it's not really, it's not like driving on.. You know North and South 13<sup>th</sup> street, where there are no road bicycle lanes and you're forced into the sidewalks which is difficult. So, but the route that I take is really easy. It's not (..) it's not particularly dangerous at all, and..*

Would you say that, in general, you're satisfied with the amount of infrastructure that is available to you..

*Yeah and the routes, you know, I uhh (..) I don't bike all over the place, or the city, you know, so.. I've done some of that, but the routes in some areas are really well done, and others are just sort of ignored. And there's a good trail system here. I ride on the trails occasionally.*

Trails separated from bike lanes

*Separated from bike lanes yeah, and mostly the Rail-to-Trail program, you know, through Hawthorne trail, north of it, you know, so I (..) I'm (..) I've done some of that, and I'm aware of friends of mine that ride, do road bikes regularly, they ride (..) for weeks (..) you know, I'm simply a commuter and I ride my bike on Saturdays or Sundays on a trail.*

Yeah, so..

*So, I think it's good, from my experience, it is a (..) a pretty supportive city for bikes.*

Right, right (..) so the quality is at a level that is high enough, for convenient commuting..

Yes.

A part from the amount of bike lanes you encounter on your commute

*Yes, yes..*

So.. if you would have to indicate something that could be improved, what would it be?

*Uhm.*

Or any specific (..)



(..) you mean in the infrastructure?

Yeah in the infrastructure (..)

(..) uhm, well bike lanes are the number one thing. Uhm (..) they put in some additional, kind-off, markings on the pavements, uh, green paint, that indicates bike, uhm (..) which I have mixed feelings about (..) I (..) As long as the bike lanes are there and those are clearly marked, I, I think that, I don't think that kind of graphics is supportive. Surely, I've noticed it, but (..) I don't feel any safer as a bicyclist, or (..) a motorist by having the paint on the ground (..) and then wonder about that, if that's cost, what that has cost. I guess it hasn't cost that much, but (..) I would rather see that in a kind of repair and maintenance of (..) of icons and bike lanes that are typical, that are international (..) you know there are graphic symbols of bike lanes (..) uhm, those are often worn, uhm (..) so I think, maintenance of bike lanes, increase in the number of 'em, would be very good (..) Uhm, they're improving the trails, they're adding more of those, so, and those are costly, so, I think that's a good idea..

Yeah.. Are these trails, uh, recreational? For recreational use, or also for.. commuting purposes?

Uhm..

(..) depends on where you live I guess..

I think I (..) I've perceived them as more recreational, I guess they can be used for commuting, but I really don't know.. I see (..) regularly I see people (..) you pass people that you see pretty much everyday, and I've noticed a couple of people that commute from South and up 13<sup>th</sup> street and down 2<sup>nd</sup>, so I (..) they're doing, what I would say, more serious commutes.. So maybe 5<sup>th</sup> (..) there's like (..) [\*\*\*\*\*] up in Planning, you know him, he (..) I don't know how often he rides.. he lives about 8 miles from here (..) and it takes him about 40 minutes to commute here. And that's through some pretty serious traffic, systems, etcetera.

So, you..

Mine is very casual, you know.. It's not uphill or downhill, elevation changes are minimal, you know.

Yeah, yeah. Well so is my commute as well. And one of the road that I take to come to campus, they actually painted these green signs, I actually biked past it the moment they were doing it, one month and a half ago or something. Uhm, but (..) you would say there's no added value to that, not in the perception of car drivers (..)

(..) for the car drivers maybe it helps, it makes it more visible, they kind of recognize maybe the bike lanes themselves, the lines but.. Uh, you get (..) they look like any other lines, and maybe that gets familiar (..) you know (..) perhaps they've done studies that show if you do that, the accident rate drops. I don't know. It's just (..) it doesn't make any difference to me one way or another.. I don't feel a bit safer having the green symbols on the ground, you know.

How would you feel about physical separation from the (..) the car lane, in a sense that the bike lane would be separated from the car lane by some kind of a, uhm..

Well actually (..) that is (..) it's been shown to be safer even if it's like, uhm (..) small debits or slight bumps in the road, that if you not (..) if you happen to drift, you'll get the vibration of the car, and it makes you conscious of where you are, and I know when (..) that in China, China has instituted that, like in Shanghai, they have bike lanes (..) pedestrian lanes and bike lanes and motorcycle lanes, and they're separated by (..) uh.. by those, the 'vibradores', vibrating strips.

Yeah, yeah..

And I think that would be good, and I think that on campus, this brick wall that they put in down here, I feel (..) I never use that bike lane, because I think it's dangerous. I think (..) I think what happened was that they forced the.. it forces the automobiles further away from the edge and back up into the other bike lane (..) And the width of it, the expense of making

*some sort of separation like that is (..) and the maintenance for the plants, and the fact that it takes up more space and it gives you less space to the bike lanes, I think it's ironic cause it makes it less safe..*

Yeah.. I feel sometimes when I bike there, that (..) that pedestrians that cross (..) the sidewalk or come through the plants, they don't have a (..) they don't even see..

*(..) they come from the automobiles, they can't see you (..) and (..) and I think it's really bad design.. And frankly, it was promoted by someone in this college, that was here, that was a bicycle advocate, a strong bicycle advocate. And, uh (..) there's an interesting (..) I was talking to Herbert Dreiseitl, of the Dreiseitl Atelier out of Germany, uhm (..) and he does projects, he's got an office in Singapore, where we discussed Bishan Park, which is a new, sort of a (---) biotope park that was reconstructed with a waterway, and its (..) it's a pedestrian area that's filled with bike lanes and walkways, and what they did was do a branching network, so rather than separating bikes and pedestrians in separate lanes, they widened the sidewalks, and they branched them and overlapped them, so that you have the opportunity to move in different directions. If you're a high-speed cyclist, you can see the route, you can make decisions, uhm (..) and there's a lot of options. You obviously need land for that, uhm.. Another place I think is dangerous is coming up on the 13<sup>th</sup> Street overpass bridge, there's an underpass for bicyclists..*

Oh yeah, yeah, I know that section. It is part of my daily commute as well..

*(..) right, where you have the graffiti wall..*

Yep, I come through there everyday..

*(..) and the lanes, are (..) confusing (..) what to do, under there*

True

*And the signs are always painted over, and the graphic shift from the ground, and neither the bicyclist nor the pedestrians know what the hell is going on (..) and so people just do whatever they want..*

Absolutely true, yeah..

*So I avoid that. But (..) I also think, on the non-infrastructure side, education is uhm (..) I think driver education (..) and uhm, bicycle education is, you know, about rights of way, safety issues, I mean (..) that's all known in the driving test, you know.. But I think, the people that don't bicycle maybe don't pay attention, or drive motorcycles.. which is a different issue. Bicyclists routinely ignore laws, they (..) they take the pedestrian route, or a vehicle route, depending on what's more convenient.*

You mentioned earlier that, for example, 13<sup>th</sup> Street, the amount of traffic forces you on the pedestrian (..) or the sidewalks, when you bike there. How do you in general cope with missing infrastructure, do you then always choose to ride on the sidewalk cause it's safer, or do you go with the traffic flow?

*Uhm (..) a little bit of both. I was watching, uhm (..) I was driving behind a bicyclist on 13<sup>th</sup> the other day, and, he's doing what I probably would. You find, that it's a lot smoother and even safer to be on the street in some moments, because the constant changing of elevation and curb breaks and cars that are pulling in and really don't see you (..) in the way that they may be expecting a pedestrian but not a bicyclist (..) and so you really have to pay attention, and it's a much more difficult route.. So I try to stay in the street, but there are no bike lanes to speak of, on that (..) I mean there's a line on the side, but in reality it's only about a foot of space.. So in heavy traffic, that's (..) you're prone to accidents more. So then I tend to move to the sidewalks, but into the streets it is a much more secure route.*

So it is less secure in the case of congestion, you would just

*(..) I tend to move into the sidewalk. And then you have pedestrians, you know, so you have to watch out for them as well.*

Cause I (..) From what I've been hearing when talking to people, car drivers in Gainesville who (..) uhm.. What irritates them sometimes about bicyclists is that they either behave themselves as, act like car drivers in the street, or the pedestrians (..) and that they take both and they just (..) and that adds to the confusion

*Yes, right, it does.. And I've noticed that, just anecdotally, and this is what I think about when I drive, is that I don't know what a bicyclist is gonna do (..) and my experience with seeing other cyclists is that most of them do whatever they want (cough) they don't slow down for traffic circles, they force the right of way, and (..) that means that motorists are not, they are not sure (..) and that causes more confusion, because they will stop, expecting you to take the right of way, and when you don't, they want you to, and they're just blocking, and it all becomes difficult.. And also, I understand that frustration if you're in a four-lane, you know (..) you're in a four lane, major arterial system, where speeds are 45 and higher, and there's no bicycle lanes, and you encounter a bicyclist in the roadways, it (..) you know, people are irritated. So I understand that, and I tend to go to the sidewalks.*

What would help to take that confusion away? Would it help to (..) for example, deny cyclists the accessibility to the sidewalks, and improve the overall infrastructure, in order to have them (..) have a fixed spot somewhere amongst the traffic flows, or..

*(..) well I think, you know, that might be the ideal condition, or you provide a widening of sidewalks which gives the option for cyclists and, uh (..) other people, and that kind of infrastructure system is really expensive, particularly when things are already set (..) and I don't see that being practical at this point.. given the state budgets, and.. yeah you know.. I think people (..) there's a good network of trails, and other things, although, there is a memorial right here, I don't know whether you've seen it (..) that was for planning students that were killed on some small bikeways.*

..that concerns the bike in the concrete block down here on the department lawn (..)

*(..) yeah, so, uhm.. I think there's.. There's some curious things that (..) when I drive my automobile to Fernandino, you know, Emilia Island, which is about two hours from here.. There's really this new infrastructure, there are all these bike lanes, you know, there's no bicyclists at all.. But it's part of the Florida trail system, you can actually come down through the East coast on the bike trails, and then come through Saint Mary's, and come through the ferry, take the fifteen-minute ferry to Fernandino, get off get on your bike and come down to the island, and then (..) you know, keep going, so.. the potential is really good there, that's like new infrastructure that they planned for the for the (..)*

(..) but there's not cyclists?

*(..) well, very few.*

(..) so why the infrastructure and why no cyclists?

*Well there are no cyclists because there are no (..) not may, the population is not very dense, and the people that are cycling don't pretend to go that portion..*

(..) Okay. Well, I've come to the last section of questions already, uhm.. How safe in general would you say that you feel when you bike to campus..

*Uhm, I would say, from a one to ten scale, it's probably eight, or nine.. You know, there's few incidents, but they've never (..) nobody's tried to run me over, or you know, or.. I have one older woman that (..) you know, went into the bike lane, and I grabbed hold of her, of the (..) of her handle on the handle on top of the car, you know (..) but she was probably only going about fifteen miles an hour, so.. But I would say that there's really no kind of daily emergency situation, it's pretty calm and easy to ride*

So for now there's no reason to switch to other commuting modes

No, not at all.

Uhm, do you have other (..) it's the last question actually (..) do you have any other general remarks about cycling in Gainesville, commuting to UF (..) about this interview..

*What are you trying to do with your study?*

Uhm, compiling the data, I would like to make recommendations and give feedback to people I've talked to so far, who are either in city council or in advisory boards, the bicycle/pedestrian advisory boards, uhm.. So it very much depends on what I'll have at the end of the series of interviews and what data I can get from the surveys, which will be interesting to see when I get to analyze the data.

*Right, yeah (..) yeah.. Well, I think that bicycling, particularly in this climate, is an excellent way to, uhm (..) to get about.. In my situation, it's pretty easy because of the distance and the location and the.. the infrastructure is good, it's kind of ideal, you know.. More people who are in a setting like that I think, they would use bicycles more (..) uhm, it is very difficult to get people out of their car, in the US in particular, because, you have stereo's and (..) well I ride regardless of rain, or if it's cold or whatever.. And I think most people don't do that.. Uhm, and if you have a family and you're transporting people, then it's more difficult, so I think anything the city can do to encourage people, you know, to do that.. And maybe it even has to be practical.. Maybe you have to look at doing a GIS analysis to find where it's more likely, where the population centers are where people are more likely to bike, or commute, or do certain aspects of their..*

Look at the hidden demand, or latent demand..

*(..) right, and maybe even look at the.. Rather than doing it everywhere, like this case in Fernandino, where they have sidewalks and bike lanes, where for fifteen or twenty miles there's like one or two houses, that population density is so small.. It seems that that infrastructure expense could have been put somewhere else. So I would say, more strategic analysis of possibilities of bike lanes for bike commuting or for something (..) even if it's just recreational (..) would be a good use of.. That's why I was wondering if the, uhh, paint on the sidewalk which is not that expensive, on a limited surface, how much that cost, and is that really effective..*

That would certainly be interesting to look at..

*(..) yeah and despite of diminishing resources, you can make an ideal bike network, but then you would have to (..) you would have to (..) there would have to be a public will to really support and push that.. You know, certainly the Netherlands is one of the leaders in that, it is a compact country, and (..) you know (..) it is easy to use bicycles for everything..*

Right, there is a certain basis in place that makes it more legitimate to use, regardless of infrastructure or behavior, the compactness..

*(..) right, and you know (..) in a (..) in a disperse network like Gainesville it is less realistic to imagine that you could do a (..) a comprehensive network.. So I guess I would recommend favoring strategic analysis of the likelihood of (..) uh (..) of using bicycles (..) motorbikes, whatever (..) to commute within a range, within a realistic range of (..) uhm, and what services might be close, and make sure that these areas are really supported by bike lanes, signing, you know (..) if that's what it gets to get people out (..) and education, for automobiles and bicycles. So and if those things really emerge, then there's the likelihood that these things will spread.. But doing it comprehensively I guess, that seems like, uh (..) too little peanut butter and too much bread (laughs)*

(Laughs) That is a nice way to put it.. Well thank you very much, I think I have asked everything that I wanted to know, and I want to thank you for your participation. It is greatly appreciated, again, and I will write it out, do the analysis, the survey analysis, see what comes out.. Thank you again.

## INTERVIEW TRANSCRIPT 2

*No. of interview: II*

*Date: 17-04-2014*

*Location of interview: outside, Plaza of the Americas (UF campus)*

Notes:

Before starting the interview, the participant's consent was asked for recording the interview on tape, in order to make transcription easier and more truthful. The participant agreed to the recording of the interview

Before the start of the interview, the participant was thanked for participation in the research, video-taping the commute and participating in the interview. The participant was asked whether he had any questions.

So, first question I would like to ask you, is (..) why do you take the bicycle to come to UF campus?

*Why do I take the bicycle? (..) Uhm (..)because it's faster than the bus, and it's good for my health.*

Do you have moments that you take other modes to come to campus?

Yes (..)

.. which one or ones is that?

*The bus.. Yeah (..) mostly when I'm too lazy to bike*

Are there other factors that influence your decision other than laziness?

*When it's raining, I'm not gonna bike. So rain, or cloudy, no (..) no..*

How often a week would you say you commute to campus?

*I never commute (by bike) during the winter, but when it's gonna be a little warmer, I'm gonna try to do it at least three times a week.*

By bike.

*Yeah.*

And how many days a week do you come to campus, regardless of commuting mode?

*That would be five (..) five days a week.*

So.. I analyzed your video. I would say that you bike on a lot of different types of roads and a lot of different (..) Like one time, you 're on the bike lane, then you take the separate trail (..) separated from the road (..) at certain sections you have to bike on the road, when there are no bike lanes..

Yeah..

Would you say that you are (..) is this path you take the shortest route to the campus?

*Well.. uhh.. I'm actually following the route from the bus I'm taking (..) 'cause I was not familiar with the routes and stuff when I came to live where I live right now (..) so it's just the easy way, I don't have to think, so..*

Right..

*I'm doing what the bus does. Maybe it's not the fastest, but I'm doing that anyway. I'm not gonna change*

And if you would know that there's better infrastructure on different routes, do you think that you would consider changing your route?

*Well (..) if it would take me less or the same amount of time, yeah (..) I would definitely change..*

But you wouldn't do a longer trip just to have a better bike infrastructure on your way to campus

*Nah (..) no (..) time is the best factor, the main factor..*

Would you say that overall, you're satisfied with the amount of infrastructure you have..

*..in Gainesville?*

Yeah, on your trip to campus (..) to and from campus

*Yeah.. I think (..) yeah, it's pretty much okay. There's just this part I don't like, it's just a little part..*

What part is that?

*It just this part where, I go on the road (..) if I go on the road, just (..) the cars are not going to be happy about that, so I just take like (..) the deviation..*

What would you like to see improved overall?

*You mean on this section?*

Yeah this section if you want, and then your whole trip in general..

*I mean (..) they could just enlarge the road and put a bike lane in or something. That would be good I guess.. Not necessary, but helpful yeah*

And in general, on the whole trip?

*Uhm.. That would.. No, most of the time, I can like (..) bike on the road, and the cars can just double me (..) but like on this road they can't, so they get pissed. I think it's not appropriate for bikes at all.*

And what about the quality of the bike infrastructure?

*Like (..) the ground? Indications? Visibility? Yeah, that is pretty much okay, even at night. Although some parts of the roads are really bumpy.. It's like, every time I ride there it's like 'oh do I have a broken, flat tire or something (..) and no that is never the case, but it is still really bad, the road is crappy*

And what do you think about cycling in Gainesville in general?

*Uhm.. You, know, it's really convenient in the weekend, because there's no busses. I use the bike to buy groceries and stuff, you know.. That is really convenient.*

And would you say infrastructure in Gainesville in general is ok? For bikes at least?

*Hmm.. I would say.. it really depends on the places. It is like (..) on my way to campus, you know, like I told you, it is pretty good. And so is it on campus. In Gainesville in general, I see a lot, a lot of bike lanes (..) and that is really cool. Like, way more than the town where I used to live. So it is pretty good in Gainesville I would say, yeah..*

When there is no infrastructure available (..) how do you cope with that?

*I go on the road. There's no other option really*

What about the safety when you 're forced into doing that?

*I mean (..) like (..) during the day, I don't worry about that, I mean (..) I myself have brakes, I'm pretty sure I won't be the one running into someone, and I don't worry I will get run over. At night however (..) I would really feel less comfortable I guess, but I'm trying to avoid that.*

How safe do you feel in general? Do you feel like

*(..) when I'm biking?*

Yeah

*Definitely safe. Uhm (..) I'm not afraid at all, no.*

Did you ever had dangerous encounters with other traffic?

*No, never (..) no.*

Do you think that other traffic flows are enough aware of the fact that cyclists are around?

*I'm sure they do, yeah (..) as I said, never have I encountered anything really bad, so (..) and I've never seen it happen. I mean, I'm sure it happens, accidents and stuff, but I've never been involved so I can't really judge you know..*

Alright, well thank you for your time and participation again!

### INTERVIEW TRANSCRIPT 3

*No. of interview: III*

*Date: 18-04-2014*

*Location of interview: participant's workspace*

#### Notes:

Before starting the interview, the participant's consent was asked for recording the interview on tape, in order to make transcription easier and more truthful. The participant agreed to the recording of the interview

Before the start of the interview, the participant was thanked for participation in the research, video-taping the commute and participating in the interview. The participant was asked whether he had any questions.

The interview started out with viewing the video. Attention was drawn to the so-called speed bumps in the road that narrow the road, intended to slow down the traffic, but where no room was left for cyclists to come by (see screenshot below)



*So (..) they put these things in for traffic calming, and it's at the end of parking (..) and what they do (..) it's these little planters with curves, but there's no place for the bikers to go, so I have to go and come to the middle of the lane*

*(..) I see, that is very dangerous yeah..*

*(..) it is very scary! And (..) you know, fortunately there's not a lot of traffic, but if there's a lot of traffic there's nowhere for the car to go and look (..) And they could've left room over here (to the right of the bump, between plant and sidewalk), but then you're hitting the car..*

*Yeah.*

*(..) so, it calms traffic down, but they didn't consider the bicyclist*



They didn't consider the bicyclist at all

*Not at all.*

As a cyclists you have to move to the left, look over your shoulder if traffic comes (..)

*And then the next thing they did was up here, they changed the light.. And it used to be, the (..) uhm (..) it would record (..) it used to be (..)*

It would record any movement, through sensors on or in the street?

*It would record any movement through sensors in the street and it would (..) it would (..) I can't remember how it is cause they've changed it a few times.. They had a (..) uhh (..) researchers out there, sitting down with a tablet. But here, I have to go up here to hit this.*



*And on the way back, there's no way to get there. So I have to wait for a car to come (..)*

Ahh okay, now I get it (..) yeah 'cause I was wondering (..) like (..) why you'd get on the sidewalk..

*(..) so I can hit the (..) so I can get a light to cross..*

Right. Because otherwise nothing will sense that you are actually here and you have to wait for a car..

*(..) and I've to wait for a car. And I've complained to the city..*

*(..) but what will makes that the car will be noticed by the system and the bike..*

*(..) the weight. You can see it, there's a patch cut out in the road. And I've been told, see, (referring to the video) it will hit it right before the light (..) and now it's going to kick it in.*

Can we see that, in the road?

*(..) let's go back a little bit (..) well no, cause I got up on the sidewalk. Let's see..*

Ah, yes, I see the lines yeah

*Yeah you see that, yeah.*

Yup, I see..

*There it is. Right there. They cut it out and they put this (..) I think it's a metal sensor.. I've been told that it'll pick up the bicyclist.. But I don't sit in the middle of the lane!*

Yeah. Exactly. So they should have made the strokes on the side.

*It's something over here that they should have made, some way to (..) you know, acknowledge a car.. And before, they had no way (..) uhm.. It used to be worse, what was it that (..) something terrible that (..) it would be that it only would register the car on one side. So if you were here, you'd get the green light, but you wouldn't get a green light on the other side cause it staggered. So when they first changed the light arm (..) There's a lot of bicyclists on this road! People will leave their car, park at the bottom of the hill (..) they don't live in the neighborhood, but they park their car at the bottom of the hill, they take their bike..*

Oh! Oh okay..

*Did you see that?*

At the bottom of the hill.. Where the parking spaces are?

*Yeah, if you go back a little.. See, here, this is commuters (..) cause otherwise you have to have a special pass. You don't need a permit to park here!*

So you don't need a permit to park or any fees involved ..

*(..) no, when we have adjuncts coming from out of town I tell them to park here and to bike, and then they have (..) you know, less than a mile ride into campus.*

So, uhm (..) is there (..) so is city council doing that, or whoever is doing that, is it special, is it intended for commuters? To park there, take their bike, sort of a park 'n ride..?

*I don't know (..) no.. I don't think they're that (..) they've thought of it that way (..) I think that it is not a heavy used parking area, they don't bother.. If it's heavy used, they protect it for the residents in the area. If this were much more crowded, I can tell you that this wouldn't be an open parking area.*

I get it, yeah..

*(..) but it just happens to be a good place cause it's an easy shot into campus. Uhm.. So this is still pretty good, and the (..) and this can be quite a wait sometimes (picture of crossing above).*

Yeah. As you see it like this, you'll say 'oh it's only two minutes'.. But once you start counting those minutes, it's a long time

*It's a long time. And I always wait to make sure (..) there's a lot of people texting and they (..) I wait, make sure cars are stopping, and then I go. Cause I've seen people flaw (..) just (..) pff (..) and not even know they run through the light..*

That is quite something I have noticed since I've been here.. I've become a passive cyclist, always in response of other's actions on the road. And like you say, everybody is calling and texting behind the wheel!

*And then here, I go up onto the sidewalk, because you see, people are not necessarily paying attention, and (..) and so for one block I'm on the sidewalk, and then I get off. But here there's no bike lanes, but it is not that busy, it's fairly comfortable. On the other side it's a little tighter cause there's no sidewalk, and the plants fall into the road, so you have to go way in and it's very narrow.*

Would you say that infrastructure on this section, which you are biking on, is (..) safe?

*I do (..) I like it. And that is why I've biking it for 23 years. Because it's (..) it's shady in the summer, it's quick (..) its faster than driving, uhm (..) but as long as the traffic's not bad its fine, because the thing that would be very dangerous are those bump-outs. You know (..) And I could, if it were heavier I would hop onto the sidewalk but there's not always a sidewalk. (..) uhm and you know and here, there no sidewalk, but there's not a lot of traffic. So I have a great location.. but I think (..)*

So bike lanes wouldn't be really necessary to

*No there's bike lanes on heavy roads like 13<sup>th</sup> street, but there's too much traffic. I'm not comfortable. People don't know enough to look out for bicycles, I'm not comfortable. I mean I see it on campus, the situations, I'm like 'ooh'*

When you bike on heavy traffic roads, is it (..) do you tend to bike within the traffic flow or rather on the side walk?

*I know it's safer statistically to be on the road. But I am not comfortable. With people texting and, you know, no, I very much prefer to be on the sidewalk, but I rarely do that. I commute to work everyday by bike, but I don't ride my bike on the weekends*

Do you bike for any other purposes?

*No. Just to get to work, as my commute to work. Whereas my husband is different, he doesn't want to commute by bike but he wants to go ride his bike on the weekends for weekends. And then I'm like.. I've done it all week, I don't want to do it. Although I enjoy this a lot .*

I have to say it is beautiful, of all the commutes I 've seen so far on tape, it seems to be a very pleasant, comfortable (..)

*And in the hot summer, Its shady. You know, and that is a big thing*

That is a big thing in Florida especially

*Yeah, and I know the spots where it's not, because I know that in the summer, and I know the slight hills.. And then here I do, because it gets dangerous, I am coming over on this side [VIDEO]*

Because you're approaching university avenue I think

*Yeah, and it is very screwy across the road, it's one way, and since I have to go left, its easier for me to go here and then immediately have to cross is a little more dangerous than (..) so I just do it this way. Now this wait isn't as long, and this button works, but again, I have to be up on the sidewalk for the button to work (..) If I happen to be in the bike lane, which there is, I wouldn't have a way to get the button to work. So they don't have bicycle (..) You know, pedestrians can walk over,*

*but they don't have anything that helps the bicyclist. So you tend to do things where you get yourself in the sidewalk with people which is not the way you're supposed to do it, but (..) and then campus is a whole different environment to bike in*

Would you say it's better (..) better to bike on than outside campus?

*It would be if you followed the rules, you know (..) but I tend to bike on the sidewalks sometimes, and if there's no classes changing that's fine, but if there's classes changing (..)*

Its very, very busy

*Not a good idea. But that's the fault of the bicyclists, for the most part. Now on the roads though, I have seen people not, still not understand that bicyclists and pedestrians have the right of way. And even though its only 15 miles per hour, I've seen some things that were pretty scary.*

*So and this is a little awkward [VIDEO] they did not plan for the bicyclists there, with these walls (8.40)*

It looks like a double sidewalk, or something..

*Yeah.. you know what it is, they just don't think about cyclists when they get to intersections.*

At least not yet.

*Not yet! Uhm.. I changed my route a while back. There was a statistic that they did on intersections, and this intersection was rated the most accidents in Gainesville. So I said I'm not gonna go that way anymore. These are some weird things, they do these walls, uhm..*

Oh so this is an actual bike path elevated from the road?

*Well, just there, cause there's no room with cars turning right onto the road. They just took some of the sidewalk. But here now it's on the road.*

Would you prefer bike lanes like these, or lanes that are physically separated from the traffic.

*When there's no traffic this is fine. When there's traffic, I want to be separated. I don't trust these people texting. Uhm (..)*

And they yeah, this is almost (VIDEO)

*Yeah I'm almost there..*

Sometimes, it's not comfortable at all to bike on campus, that's what I've noticed. Some sections are really bad.. Even if there are actual bike lanes, the pavement

*Oh the quality of the pavement*

Yeah the quality of pavement is really bad

*Yeah and I even have shocks on my bike.. Uhm (..) What's interesting, have you ever done these intersections at like 5 o'clock in the afternoon?*

Uhm..

*They always have a policeman here.*

Oh yeah, I 've seen that!

*And they make you wait..*

But this is Plaza of the Americas here to the left..

*Yeah. Yeah.*

Yeah that's true, I ve been there a couple of times around that time..

*Now to go my way home, I need to go this way, but all cut through the Plaza of the America's, and its packed, and that's the only time I've fallen. Its at the Plaza of the America's at five o 'clock. And it's because there's all these people around the side walk, and they don't see you coming, so I get off the sidewalk.. And this was when it was a really dry year, it hadn't rained a lot.. and in that loose soil, my bike slipped off and I just went.. And I hit (..) I mean I'm glad I wore a helmet, cause I mean I hit my head really hard. And I didn't see it coming, it happened like that. Cause I was purposely going off, and even still it was just so sandy it just (..)*

Lost all grip

*Oh yeah totally, completely wiped out and it was like, 'woah'*

So is that the only time you've

*Yeah only time I've fallen.*

How many times for example do or did you encounter dangerous situations? Yourself, or which you see around you?

*No.. I ve just waited, cause I'm very cautious, at the red light (..) And I take a very non-busy route, but I've.. (..) and I shouldn't say that (laughs) you know, cause, I've been very lucky.*

Yeah. Absolutely

So, what I wanted to talk about.. I have a lot of questions but I also think we've gone through a lot of them already.. uhm (..) but what I'd like to know is, what is the main reason you choose to commute to UF campus by bike?

*Well, it's very pleasant. It's faster than driving, and I have a parking spot at the front door every day. And, I can do that, the weather generally works, it rarely rains in the morning. If it rains at the end of the day, it doesn't bother me. I have a poncho, my backpack stays dry, I can take my shoes off and I have flip flops I can wear, I get home and I take my clothes off. I can change. The rains in the morning, it's much harder to change clothes here. But it rarely rains in the morning.*

Are there ever moments that you come to campus on another.. using another mode?

*I do. There are times when (..) my son was younger. And, in the summer, my husband travels a lot and is gone, so I single-parent a lot, and there were times where I had to be (..) I had to go pick him up, and I had to go all the way to go pick him up. So, that (..) now he drives, and I don't have to do that as much. But when I bring (..) or when I have to carry heavy things, or bulky things, that I can't bring on my bike (..) I'll have to drive in. Uhm (..) but other than that, I much (..) plus I really like the exercise. You know, I have a hill, and in the winter time the hill in the morning gets my blood pumping. It wakes me up, and then (..) in the afternoon, it just gives me that break where I shift my mindset from this [points around the office] to not being at work.*

Emptying your head off thoughts (..)

*And driving doesn't do that. Driving doesn't do that, driving keeps me there, but there's something about biking and the air in your face.. and the smells and the sounds, and it's so different than (..) that it mentally makes a really nice break.*

Now, and I think we've pretty much gone through this as well, but (..) do you deviate from the shortest route to use bike infrastructure (..) I don't think that is the case, but (..)

*I use the same route everyday. I did change it, I used to do a different route, but then I saw the traffic study, and that the intersection I used to use everyday had the highest accident rate.. And I know of two people that have been hit by cars there.. One was a at this faculty, and one other guy.. So then I said I'll change, I take another one, it's a much quieter road and it works much better.*

So, on that same route that you bike everyday, if better infrastructure would be available on different roads, would you consider changing your route again?

*Sure! As long as it was comfortable, yeah (..) it has to be shady. Gainesville can get pretty hot, you know.*

I've noticed that

*Yeah sure you have*

I mean, not summertime-hot.

*July and August, its just, pff.. shade is really critical.*

Yeah. Would you say you are satisfied with the infrastructure available on your current route. What is in place already.

*Yeah (..) you know, there were times that I was really frustrated, when they changed that light, cause what they had before worked really well. But I've gotten used to it, and it works, and it works also because there's not a lot of traffic. I think if there was a lot of traffic, and I had to get out of the way, or when those bump-outs were there, I wouldn't. But for now, for the level of car traffic, it's okay.*

Coming back on these traffic lights, you say they've changed it, what was the reason for (..)

*A new standard. Before they used to be two lights on a cable (..) where they would hang. And now it is those metal, black arms. They changed, so I think they are better in wind, because I think we had hurricanes here quite a few years in a row, and they just didn't hold up, so I think they went through and changed all the traffic lights in town.*

And they changed the way it worked with it?

*And they changed the way it works. And they've also changed the lights, they've also added a new, flashing yellow arrow, that didn't use to be on our lights before. So there s a new thinking in traffic management that they implemented. And they also changed that, before both lights would be green, and you could go (..) now, one goes first, and you can push the button, only as pedestrians (..) so they've added more complexity to it.*

Does that make the waiting times longer?

*Yeah it does.*

But overall (..)

*But that is not the problem (..) the (..) it's gotten better, they made it a little more sensitive so they (..) before, you'd have to sit there and wait until a car came. Now, it seems to be more sensitive, or it doesn't last as long.. cause otherwise you'd sit there, and I'd eventually just run the red light. Cause, nothing would happen. But on the other side, coming towards campus, I could hop upon the sidewalk and hit the button and be able to keep going.*

What would you (..) apart from that (..) what would you like to see improved?

*The bump-outs are dangerous. Because there s no way to go, and now I have a sidewalk that I can hop on, and I do that. But (..) and I partially do that because it's on the way home, and I'm going uphill, and there s a stop sign. And if I hop upon the sidewalk, I'm technically a pedestrian, and I don't have to stop. Cause I could get ticketed if I stop on the road (..) so I'm playing with the law.*

*But otherwise, you should stop, and then you have to pick upon this hill. Most people don't do what I do, most people just fly through that stop-sign, they don't stop. Uhm (..) I don't think it is particularly dangerous, but the two bump-outs, if you ever happen to have cars coming in both the same way and somebody wasn't paying attention in there you'd get hit*

There's no room for

*There's no room for me, nowhere to go. And those they added recently, only a few years ago, they didn't use to be there. And they slow the traffic down, but they never considered the bicycles. And what they could have done, was (..) you know (..) if there's no cars parked on either side, make it narrow enough and you can go around on this side and come back out. But there s no way to (..) you can't..*

Yeah. When there's no bike infrastructure available, how do you tend to cope with that?

*Sidewalks. Yup, and when there is a (..) I know I'm supposed to go against the traffic, but it's very uncomfortable.*

So pedestrian (..) you mean, once you bike on a sidewalk, you'd have to go for the left sidewalk.

*No no (..) sidewalks don't matter to me. Usually I'll go with the traffic on the sidewalk. Uhm, but if I'm in the road and there's no bikelane, I guess I go with the traffic. If I'm walking I walk against the traffic, so I can see them.*

Oh right..

*At least that's what I've read, it's more safe.*

Cause the opposite side sees you coming and you yourself can't get hit from behind, go out of the way..

*You can get right out of the way, if they come from behind you they won't see you. With biking I don't know if that's the case, but I tend to bike with the traffic.*

So that was actually my next question, what implications does it have for safety? When you have missing infrastructure, you mix with the (..) well you ride on the sidewalk, you occasionally mix with pedestrians

*Right, and that is not safe either.*

And (..)

*Because, they're usually plugged into their music. And you're supposed to say 'on your left, on your left', and (..) so I'll slow my way down.. So the iPods are a bit of a problem, cause they don't hear you, they move over, they're oblivious..*

And still, apart from that, mixing with the traffic flow isn't an option for you.

*Uhm, I don't feel comfortable.. Basically, because people are texting, and I know of a woman who was hit, in a bike lane, and was paralyzed. People weren't paying attention and then they just reared of.. And then there's no rumble strip, there's nothing to warn you that you 're doing that. I just see too many distracted drivers, and it 's just like, 'nah'.*

One of the other interviewees mentioned them as well, those 'rumble' strips, or 'vibration' strips, would that be a good addition to the existing infrastructure?

*Oh yeah. It would make me feel safer because it would (..) the driver, as soon as he goes over there, he's, 'oh, wait a minute'*

It wakes you up

*Yeah, yeah yeah, but this person was hit, even with the rumble strip..*

Oh.. so there are rumble strips

*Paynes' Prairie. You know 13<sup>th</sup> street all the way down? Do you know the big prairie that you go down? There are rumble strips there. And (..)*

Ah okay. That is pretty (..) I mean, the speed on that road is..

*It is 65..*

65 mph.. that is fast.. I wouldn't (..) I would hesitate biking there

*That is fast. Yeah. But it is a very popular biking route. For people that like to roadbike, they're always going down there. And going, you know, doing their 10 mile 20 mile rides, and then come back..*

But it is along the road, and not a separate (..)

*Nope, it's on the road.*

[..]

But in general, on your commute, you feel safe?

*I never had any close calls.*

What about cycling in Gainesville in general? Even though you might not cycle a lot

*I don't tend to do much. But you know, my husband and my son do, and (..) you know, I think it is safe except for the distracted drivers.. So but that is more recent. We didn't use to have texting. So texting has just been the last few years. And I've seen a lot more people run through the red lights, a lot more people wandering off. And not know, have no idea that they're doing it.*

Is that something that is being considered? Governments, or the national government, considering to ban texting and driving?

*Yeah, they tried to pass a law in Florida, and they didn't approve it. Last year.*

Why not?



*Because of your rights.*

Freedom.

*Freedom.*

The freedom to text in your car.

*The freedom to do whatever. It's crazy*

It is something that I.. when I got here, the first two weeks, when I drove my bike around at 5PM, I live close to Sorority Row, and everybody there is just driving, texting and driving, and I noticed that, most of the people don't drive with a stick. In the Netherlands it is forbidden to text and drive, but it is way harder, because once you are in city traffic, you are (..) you don't have three hands. So

*Right, right. And that is why I got my son a stick-shift. Because it is harder to text.*

And it keeps your attention on the road

*I just wanted him to not be able to do this and just drive, you know, you have to be doing this, and just (..) And I paid for Bluetooth, so that he didn't call..*

Handsfree calling

*Yeah. Too tempting. Even though he is like 'I know, I won't do it, I won't do it', I'm just like, no, I'm not gonna go there. And yeah, it needs to be a law, but.. I don't know when that will happen.*

Do you have any other, general or additional remarks about commuting (..) commuting in general, or to UF. Or your commute?

*I love it. And I don't know why more people don't do it. Maybe, I think, they're worried they're gonna sweat.. And in the morning, it's not (..) I mean, I have a little fan here, you know (..) I might have to take my sweater off, or whatever. In the morning I have to wear a few layers (..) uhm, you know, and in the afternoon I might not wear it! You know, but I can take a bungee chord and tie it on to my rack. Uhm. It's not a big deal.*

What do you think would get more people to cycle here in Gainesville? I mean, what active policies or, apart from infrastructure. Is it a safety issue, is it a (..)

*I think it 's a mindset, I think that, some people aren't very healthy minded. And walking, I see a lot of people taking the elevator. It s that mentality. It's like, you know, I try to get exercise everyday, every time I can, because I sit here all the time. So it's an attitude, I think some people think that they 're going to get too sweaty. And it's like, that you have to be dressed in a sporty way.. I mean, I (..) I wear pants, I don't wear dresses to work. So I mean, it affects my wardrobe (..) I don 't know if that's a big deal to people. I have a backpack, I don't have a briefcase.. I don't know if that's a big deal.. I bring my lunch everyday, I have additional weight. I mean, it's (..) I bring a whole thing of water.. It's uhm, it's not a problem, for me (..) I live on a really nice residential street, so it's a very pleasant commute. I've talked to faculty members who live on, who would have to go on more dangerous roads, and they tried it, and they stopped trying. I think there are more people who don't live with the best commute. And I think that that 's really important.*

So, to change people's attitudes, or their circumstances in which they could commute by bicycle, would it be about (..) improving the circumstances to cycle, or rather make it harder to commute by car?

*I think, make it better to bicycle. Because I think a lot of people in Gainesville are healthy-minded. And I know people who've tried it. Uh, and I've seen them here. But they just give up. Cause it's just not safe enough. I think, if (..) if traffic engineers kept the bicycle in mind every time they make a decision, like these stupid bump-outs. You know, it (..) every time you make a decision, don't just consider the car, consider pedestrians and consider cyclists. And, if streets were shady enough, because come summer weather they'll say 'forget it'. You know, I think you could increase it. I think you could. I also think there needs to be a different approach to planning. I think for long time, the interest was, we'll just keep building student housing, I mean, we have dorms, they were full. Student housing will be out there and students can drive to campus. Why don't you do infill? I've always said that the 2<sup>nd</sup> avenue between campus and downtown, should be five storey, student housing housing*

High density, close to campus

*You can bike, you can walk, there can be a trolley. You can hop on it, and in a minute be downtown for lunch. Come back, you can live there, you can be..*

And they're building there right now

*And they're doing it right now, but at first this wasn't the policy. This is now the thinking, but there's been so much built out there that forced people to have to drive in. They did bring busses, so some people will take buses, but forever, that's where they were building. And I was like, why are you building student housing so far away? And I've been on (..)*

On Archer, on

*(..) and I've been on committees, UF committees, the parking committee, and people on that committee were like, 'oh no, we need to make four-lane roads, cause we have a traffic problem'. I said we have traffic problems because we don't have housing close enough for people to walk. So there's a planning, uhm.. educational component that needs to happen. So I think its land-use, I think it's infrastructure that keeps the cyclist in mind, and I think it's microclimate, you know, have enough shady, comfortable (..) I mean, look at my ride. And I, when I moved here, I lived in D.C. and walked in Baltimore. I commuted three hours a day. Now granted that I walked to the train station, I took the train, it was all public transit, but it was three hours a day. This is, like, amazing. And after 23 years I still think it's amazing, that I can do this. That's fifteen minutes.*

What I've noticed since I've been here, and what I've read before I came here.. I've been (..) reading on the American planning style, the problems with urban sprawl, and (..) urban areas that are way less dense than in Europe, I feel like to have a successful transit and cycling system, you have these basic conditions that you have to fulfill and keep in mind. And one of them is density, to make the whole system work..

*Yeah. Density scares Americans. You know, in Florida especially. And (..) I think, and this is something we've talked about among the faculty (..) is that we're trying to get rail in Florida. And so we know we need more density. And people think density means Manhattan. There's another (..) there's an in between. And so part of the challenge is to show them that there's an in between. That it doesn't have to be a Manhattan, that it can be something that maybe is five stories, that still is dense enough to , you know, counter that sprawl. But you know, land is cheap here. You know, in Europe, you don't, you have to. And when there's so little available, that it is more expensive, you treat it more carefully. Here it just, 'let's spread out', you know. So it makes a difference.*

So I think, it might be the chicken or the egg, what comes first. In order to have a successful transit system, you have to target it. And if you don't have the density, it doesn't make any sense, you cannot target it right, so what do you do first.

*Right, right. How do you tip that over to the other direction. I think in Gainesville, uhm, we had some really smart people making decisions about encouraging development on 2<sup>nd</sup> avenue. That they understood that implication. I'd like to see more student housing and more affordable housing, it is really high end and more the high-tech hub. You know, uhm, medical, and offices, you know, okay. We'll do that, but I'd love to see more student housing and a mix of affordable housing, and not just high-end housing.*

More of a high-density, transit corridor (..)

*Yeah, yeah, get smaller apartments, you know, they don't have to be these luxury condo's. Get a lot of students in there. You know, so that you can have (..) you know (..) force students in a two-bedroom condo and just (..) pack 'em in there and really reduce the traffic down. Not everybody can afford a car, not everybody can afford (..) you know.. these are really high end, expensive condo's, and these are the people that have cars, you know. So a little bit of that mix-use so that you could try to (..) now granted that there's a much better bus system now. It really worked out well. So the bus system is really really improved.*

From the people that I've talked to at UF, they say it's very good, especially for such a small community as Gainesville.

*It didn't use to be there. But, it's gotten there.*

How?

*I think part of it is that students with an ID card ride free. That makes a big difference. And so they've invested in new (..) more buses. And they have more buses coming on the routes, so you don't have to wait for an hour for a bus.*

And what was the drive for RTS (Gainesville Regional Transit System) to invest in more buses?

*Education. They just realized. The right people were making the decisions that we have to invest in that. We can't keep on building more roads, we can't keep building out. Now (..) you know, we get really educated people, and then we get people that don't understand as much (..) and so we've had enough people that understood, in a position to make decisions to create the infrastructure that is there. But there still are people that believe we need to add other lanes so we don't have congestion, instead of rethinking land-use, and mass transit, or cycling, you know, in more options, to make it multimodal.*

How do you foresee that future, for Gainesville?

*Well, you know, I think if we have an energy crisis, it would really help, in that regard. Because then people would say, wait a minute, why do we keep on (..)*

On having that reliance

*(..) that reliance on fossil fuel, why can't we do something that is a little different (..) uhm (..) I think that would help. You know, politically, it just changes. It gets (..) you know, we get very educated people, to know and understand these issues, to come in and do good things, and then (..) the other.. It's a pendulum. But I've seen an improvement, you know, I've seen (..) 2<sup>nd</sup> avenue was headed in the right direction, and then the economic downturn hit, and it all stopped. But I think it is all going to come back. And so, we'll if that happens. You know, but (..) fuel is still so cheap here. So cheap. So people are like (..)*

I don't even know how that is possible.

*And people don't realize what the price of it is, compared to European countries for example. It is three times more expensive in Europe. So you know, there's another incentive. And here, it is like (..) they don't even think twice about, you know (..) living.. I would never, never live (..) as a student (..) when I look at these students I'm like (..) wouldn't you wanna live where you can walk or bike? And nah (..) they don't all think about those things. It's just not (..) it's not part of their mindset.*

I guess it's all about (..) charging the right price for the right mode, and making the car

*See, and this is where economics would be an incentive. For that demographic (..) you know. That would definitely help a lot.*

These are all the questions I have. I want to thank you very much for your cooperation.

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## Appendix 12 – Interview code book

Coding family 1	Coding family 2	Coding family 3	Code
Mode choice motivation	Current	Main mode	"like cycling"
			"pleasant commute"
			"speed"
			"conservation"
			"convenience"
			"being outside"
			"health"
			"exercise"
			"cheap"
			"clear the mind"
		Alternative mode	"when raining"
			"too hot"
			"carrying heavy things"
			"lazy"
			"kids"
	Past	Main mode	"kids"
			"distance"
Current itinerary	Motivation of use		"shortest"
			"used to"
			"shade"
			"low traffic"
			"safe"
	Motivation for deviation		"fast traffic"
			"parents w kids in car"
			"bored"
			"construction"
	Casualties during		"collision"
			"falling"
			"dangerous situation"
Infrastructure	Amount	Bike lanes	"sufficient"
		Bike paths	"room for improvement"
		Bike trails	"
	Quality	Bike lanes	"
		Bike paths	"
		Bike trails	"
improvements	Bike lanes	demarcation	"symbols"
			"vibrating strips"

		bike infra grid	"meet demand"
			"latent demand"
			"target development"
			"costs"
		technical improvements	"traffic lights"
			"sensors"
			"bump-outs"
		community	"push innovation"
			"increase demand"
			"education"
When no infra available	Ride on-street		"mixing with traffic"
	Ride off-street		"sidewalk"
Mixing with traffic	Rush hour		"safety issues"
Safety issues	Other traffic		"Buses"
			"Pedestrians"
			"Cars"
	Pavement		"bumps"
	Distracted people		"Texting"
			"Calling"
			"iPods"
	Infrastructure		"Bump outs"
			"Physical separation"
General remarks			"planning approach"
			"density building"
			"concentration"
			"gas prices"
			"mindset"

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## Appendix 13 – Interview quote boxes

### Box 1 – Quotes on motivations to cycle to work

#### ["like cycling"]

- *"I love riding my bicycle (..) the speed, the directness (..) the bike as a piece of equipment (..)"* – respondent 1
- *"It is very pleasant (..) in the morning, it gets my blood pumping. It wakes me up and then (..) in the afternoon, it just gives me that break, where I shift my mindset from (..) not being a work (..) It mentally makes a really nice break."* – respondent 2

#### ["speed and convenience"]

- *"It is faster than driving"* – respondent 1
- *"It is faster than coming by bus"* - respondent 3
- *"I can get from my home door to my office door in less time than I can drive to campus, park it in the garage, come down the elevator, walk five minutes (..) plus all of the hassle getting it in and out of the garage, of parking the car (..) – respondent 1*

#### ["exercise"]

- *"I really like the exercise (..) I try to get exercise every day, every time I can, because I sit in my office all day"* – respondent 2

#### ["cost and conservation"]

- *"(..) the fact that I'm not spending that much gas on my car (..) I'm producing less pollution, there's less automobiles on the road, so I guess conservation issues"* – respondent 1
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### Box 2 – (dealing with) perceived difficulties to cycle to work

#### ["weather & climate"]

- *"When it's raining, I'm not going to bike"* – respondent 3
- *"The weather generally works. It rarely rains in the morning. If it rains at the end of the day, it doesn't bother me. I have a poncho, my backpack stays dry (..) I get home (..) I can change"* – respondent 2
- *"Gainesville can get pretty hot, you know. (..) August and July, it's just.. pff.". (..) "I think they're worried they're going to sweat (..) that you have to get dressed in a sporty way"* – respondent 2

#### ["baggage"]

- *"when I have to carry heavy things, bulky things that I can't bring on my bike, I'll have to drive in (..)"*

### Box 3 – Quotes on motivations for current itinerary

#### ["Safety"]

- *"I used to do a different route, but then I saw a traffic study, and the intersection I used everyday had the highest accident rate (..) So then I said I'll change, I take another one, it's a much quieter road and it works much better"*

Box 3 (continued)

- *"(..) South 1<sup>st</sup> street, people drive as fast as they do out on Main street (..) There are bike lanes, and there's automobiles on the side, but I quite frankly feel safer in the middle of all of the traffic with the bike lane than I do on that street.*
- *"There's bike lanes on heavy roads like 13<sup>th</sup> street, but there's too much traffic. I'm not comfortable".*
- *"People are often not paying attention (..) I assume that automobiles are really not paying attention or they don't care.."*
- *"People driving with children, they're not paying a lot of attention." And "basically, people are texting (..) and they wander off"*

**["Habit"]**

- *"I actually follow the route from the bus I'm taking, cause I was not familiar with the routes when I came to live here (..) it's just the easy way, I don't have to think"*
- *"(..) Sometimes, I get bored and I just go another way (..) But I guess, when you're going to work, you have your mind set upon other things, and I like a repetitive route, you know, I know exactly what's going on (..) you know the road (..) the conditions of them, what to expect (..).*

**["Shortest route"]**

Box 4 – State of infrastructure

**["Amount"]**

- *"I think it is a pretty supportive city for bikes (..) I think it is good. (..)*
- *"In general, it is pretty good in Gainesville, I would say (..) in Gainesville in general, I see a lot of bike lanes (..) way more than the town where I used to live".*
- *"The increase in number of bike lanes, that would be very good"*

**["Quality"]**

- *"The routes in some areas are really well done, and others are just sort of ignored.."*
- *"Maintenance of bike lanes (..) would be very good*
- *"Some parts of the road are really bumpy. It's like, every time I ride there it's like, do I have a flat tire or something?"*

**["Improvement"]**

- *"Well bike lanes are the number one thing I would like to see improved (..) They put in additional, kind of, markings on the pavement, green paint (..) which I have mixed feelings about (..) as long as the lanes are there and they are clearly marked, I don't think that kind of graphics is supportive (..) I don't feel any safer (..) by having that paint on the ground"*
- *"Small bumps or slight bumps in the road (..) that if you happen to drift, you'll get the vibration of the car, and it makes you conscious of where you are (..) vibrating or rumble strips (..) And: "It would make me feel safer (..) the driver as soon as he goes over there, he's like 'wait a minute!'"*
- *"they put these things in for traffic calming (..) it's these little planters with curves, but there's no place for the bikers to go, so I have to go and come to the middle of the lane".*
- *"If traffic engineers kept the bicycle in mind every time they make a decision (..) like these stupid bump-outs (..) every time you make a decision, don't just consider the car, consider the pedestrians and consider cyclists.."*

Box 5 – Cycling and dealing with missing infrastructure

**["Mix with traffic"]**

- *"I go on the road. There's no other option really"*
- *"I understand the frustration [of drivers], if you're in a four-lane, major arterial system, where speeds are 45 and higher, and there's no bicycle lanes (..) and you encounter a bicyclist in the roadways, people are irritated (..) So, I understand that, and I tend to go to the sidewalks."*

**["Sidewalk"]**

- *"I know it's safer statistically to be on the road. But I am not comfortable (..) with people texting and, you know, I very much prefer to be on the sidewalk."*
- *"New issues emerge, because, they [pedestrians] usually plugged into their music (..) they don't hear you, they don't move".*

**["Both"]**

- *"I either choose to ride on the sidewalk or go with the traffic flow. You find that it's a lot smoother and even safer to be on the streets in some moments, because the constant changing of elevation and curb breaks and cars that are pulling in and really don't see you [on the sidewalk] (..)"*
- *"I really try to stay in the street, but sometimes there are no bike lanes to speak of. So in heavy traffic you're prone to accidents more. So then I tend to move to the sidewalks, but into the streets it is a much more secure route."*

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