

ANALYZING INTERVENTIONS FOR INCREASING BICYCLE COMMUTING

HUMBOLDT STATE UNIVERSITY

By

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ABSTRACT

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Bicycle commuting decreases traffic congestion, decreases dependency on oil consumption, and mitigates critical health conditions like heart disease and obesity. Yet, it is a challenge for non-profits, governmental and community organizations to increase bicycle commuting. I analyzed and reviewed several interventions (e.g. bike lanes, bike parking, education programs, traffic calming, etc.) presented in research for increasing bicycle commuting. I also employed an ethnographic research method from an emic account by conducting interviews of various commuter types in Eureka and Arcata CA and Corvallis and Portland OR. I identified the interventions they perceived as the most ineffective or effective for increasing bicycle commuting. I answered the question: What are bicycle commuters' perceptions of the interventions presented in research literature? Answering this question led me to develop a model for dealing with how to approach the implementation of interventions. This model may help determine which interventions are perceived by bicycle commuters as the most likely to increase bicycle commuting, and assist planners in developing appropriate interventions for their community.

Key Words: Bicycle commuting, bicycle commuter, sustainable transportation, alternative transportation, ethnography, biking, barriers, interventions.

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CHAPTER ONE: INTRODUCTION

Bicycle commuting decreases traffic congestion, decreases dependency on oil consumption, and mitigates critical health conditions like heart disease and obesity.

The bike offers a non-polluting, non-congesting, physically active form of transportation in a country, and in a world...where heightened global competition for the world's oil supplies has ended the era of cheap fuel that made our automobile dependency possible (Mapes 13).

Since 40 percent of trips in the U.S. are less than 2 miles, a bike is an adequate substitute for those trips rather than using a car (Mapes). Worldwatch institute documents that riding a bike for four miles keeps 15 pounds of pollutants out of the air. Because automobiles are a source of air pollution in the U.S. (Crombie et al.), and since bicycle commuting is a zero emission form of transportation, our community will have cleaner air if bicycle commuting is increased.

Bicycle commuting helps keep us healthy, too. Bicycling is an excellent source of exercise that helps us combat obesity, heart disease, and asthma. According to the League of American Bicyclists "recreational bike riding is a safe, low-impact, aerobic activity for Americans of all ages. A 150-pound cyclist burns 410 calories while pedaling 12 miles in an hour." Physical Activity Guidelines Advisory Committee reports that physical activity reduces the risk of cardiovascular disease, hypertension, colon cancer, type 2 diabetes, and improves mental health. The Bicycle Transportation Alliance concurs with the Physical Activity Guidelines Advisory Committee and states that the cost of health problems associated with obesity in the U.S. in 2000 was \$117 billion. If bicycling were

incorporated into one's daily routine and commute, their community would be healthier, save money, and decrease healthcare costs.

Bicycle commuting saves money in other ways. The Office of the Federal Environmental Executive states that bicycle commuting decreases absenteeism, increases employee productivity, and reduces parking and maintenance cost. The League of American Bicyclists echoes this sentiment stating purchasing and maintaining a bicycle is far less than a car. Commuting by bicycle does not require people to fill up on gas, helps them save money, and decreases the dependency on oil production. Moreover, bicycles take up far less space than cars and cause little wear and tear on the road (League of American Bicyclist). In the equivalent parking space required for two cars, 10-15 bicycles can be parked.

Bicycle commuting offers a great deal in savings, healthcare, and for the environment. Yet, it is a challenge for community and governmental organizations to increase bicycle commuting.

According to Jennifer Dill and Theresa Carr, the predominant use for bicycles in the U.S. is for recreational activities rather than for utilitarian purposes, such as shopping, riding to work, or school. Furthermore, Dill and Carr have argued that people may be commuting more because there are more lanes and paths. In "Infrastructure, Programs, and Policies to Increase Bicycling: An International Review," Pucher, Dill, and Handy conducted research to assess the actual impacts of the various interventions on levels of bicycling. They concluded that substantial increases in bicycling require an integrated package of many different, complementary interventions..." (s106). The United States

Department of Transportation Federal Highway Administration echoed this when it concluded in its national bicycling and walking case study “no single improvement will be sufficient to attract all potential bicycle commuters to cycle, and that some sort of integrated approach is the best bet for stimulating mode shifts” (24). However, it emphasized that public input, especially from bicyclists, would effectively aid in the appropriate mix of interventions. My research attempts to fill this need through the acquisition and analysis of bicyclists’ input.

It is essential for appropriate planning to understand the public’s perception of bicycle interventions. Therefore, I have analyzed the interventions (e.g. bike lanes, bike parking, education programs, traffic calming, etc.) presented in research for increasing bicycle commuting. From my analysis I answered the question: What are bicycle commuters’ perceptions of the interventions presented in research literature? In order to answer this question I had to consider other issues. Why do people commute? How far do people commute? How often do people commute (distance and trips per week)? Why do people choose not to commute? What are the barriers commuters face? What would entice a person to commute? Of the interventions presented in literature, which ones are familiar and which ones are not familiar to the commuter? Bicycle commuting is good for a number of reasons, but what actually works to get more people commuting and to design better and more appropriate infrastructure?

I hypothesized that my research participants would have several significant concerns. Regardless of commuting frequency and riding ability, they would—to some respect—be concerned for safety, time, distance, and weather. I also anticipated that the

participants would not understand the use of the word intervention when referring to the various bicycle interventions in the interview. Additionally, I assumed that many, if not all, would not understand all or some of the various interventions I was investigating.

My research required an understanding of a bicycle commuting culture. For this project, a bicycle commuter is defined as one that commutes by bicycle at least once per week for utilitarian purposes (e.g. to work, to school, or shopping). I have also used the word intervention as defined by Pucher et al. in “Infrastructure, Programs, and Policies to Increase Bicycling: An International Review.” Interventions include infrastructure (e.g., bike lanes and parking), education and marketing programs, bicycle access programs, and legal issues. Descriptions of the various interventions as defined in “Infrastructure, Programs, and Policies to Increase Bicycling: An International Review” can be found in Appendix B.

The thesis road map is as follows. I include a review of the literature emphasizing the major themes and debates found in bicycle commuting research. This is followed by a detailed description of my epistemology, methods, methodology, which highlights how I chose my interview questions and performed an analysis of my research. From there I provide the results and discussion of the research, elaborating on key themes and how they compare and contrast to current research. Finally, I provide a conclusion that summarizes the key findings and discuss their importance in the bicycle community. Moreover, the conclusion sets the stage for new research.

CHAPTER TWO: LITERATURE REVIEW

When considering major social change it is beneficial to look at the opposition and the barriers preventing or slowing the change from occurring. Barriers are the fundamental hurdle to overcome. Efforts to increase bicycle commuting are no exception. Research suggests several barriers to consider when developing strategies to increase bicycle commuting. However, a common theme that resonates throughout the available research is a concern for safety, perceived or real. In an effort to give the reader a greater understanding of the difficulties associated with increasing bicycle commuting, a concise review of the barriers associated with current and potential bicycle commuters follows.

Safety: Perceived or Real Problem?

Concern for safety is expressed by a majority of commuters and potential commuters as the significant barrier that affects commuting habits (Bureau of Transportation Statistics, Baumen et al., Boelte, Gardner, Landis et al., Pucher et al., Royal et al., and United States Department of Transportation Federal Highway Administration). A question posed by many researchers is whether the concern for safety is perceived or real. A survey conducted by the Bureau of Transportation Statistics illustrated that without bike paths or bike lanes bicyclists felt endangered mostly by motorists. In a similar study, the “National Survey of Bicyclists and Pedestrian Attitudes and Behavior” found congruent results. One in ten bicyclists (results were pretty equal across gender and age groups) surveyed felt their personal safety was threatened on the

most recent day of riding. “The common expression of bicyclists concerning how well a particular street or road accommodates their travel is from a perspective of safety” (Landis et al. 120). Additionally, Gardner wrote that “[b]icycling is often perceived as unsafe...” (4). Horton examined the typical barriers to cycling. “So, fear is an important *emotional* barrier to cycling” (Horton, emphasis in original, 133). Horton explored the contemporary fear in society. Fear of cycling, according to Horton, is culturally constructed. Fear is produced and perpetuated through the construction of cycling as a dangerous practice. He contends that wearing a helmet, for instance, sends the message that cycling is so unsafe that a helmet is required in order to make it safer. Ultimately, Horton asks many important questions. Is the fear of cycling real? If cycling is proposed to be a safe activity, then why is a helmet promoted as a necessity when cycling? He further contends that the fear of cycling is exacerbated by the very interventions used to hopefully increase cycling; in turn, perpetuating the fear of cycling. An intervention such as a bike path separates the bicyclists from the roads sending the message that it is safe for you to be on the bike path, but not safe for you on the road. Fear is a significant barrier to cycling, but “[i]ronically, this fear is partly produced through attempts to make cycling safer” (141). There is a considerable foundation to Horton’s argument that fear is socially constructed and perceived.

Taylor et al. echoed this sentiment. They argued that off-road or separated interventions will increase the perception that cycling is safe and more enjoyable. They agreed with Horton that the perceived fear of safety is an issue that needs to be addressed when developing, planning, and implementing various interventions and policies.

Further, they, along with Moudon et al., further found that the three major barriers that should be the “primary focus of policies to encourage cycling” are a lack of perceived safe conditions, a lack of showering and changing facilities at the workplace, and making sure that riding is a fun activity (Taylor et al. 4).

Andrea Chan countered the theory of perceived safety in her thesis, Identifying and Removing Barriers to Cycling as a Viable Means of Transportation in Houston, Texas, that “[t]he fear of injury perceived by bicyclists is a real danger, as an average of 50 people in Texas die annually from bicycle accidents” (7). Many of these deaths are related to the actions of motorists. However, Horton’s arguments that fear is exacerbated through the design and implementation of interventions such as promoting helmet use is problematic. Chan believes safety is a real concern, and the utilization of bicycle helmets, for instance, will reduce the threat of injuries and make the bicyclists more visible.

A lack of attention given to improving bicycling safety increases the unsafe conditions of getting around American cities (Pucher et al., “Promoting”). Therefore, it is necessary to increase safety measures and policies to increase ridership and make bicycling more feasible and safer (Pucher et al., “Cycling”). It is also helpful to determine if the concern for safety is perceived or real, so that planners may develop more appropriate measures to address the safety concerns. My research aims to shed light on this debate. To make informed decisions about bicycle commuting, Americans should know that bicycling is safe; they must feel safe, and know that the benefits of cycling far outweigh any of the negative costs or consequences associated with cycling (e.g. having

an accident, costs of owning a bicycle, slower speeds, community perceptions, etc.).

Improving safety will increase trips by bicycles and provide valuable opportunities for exercise, fun, decreased traffic congestion, energy consumption, and reduced air and noise pollution (Gardner. Pucher et al., “Promoting”).

Increasing the Safety of Bicycling

There are many methods to increase safety. One theory suggests the more riders that are on the road the safer it is to ride (Bauman et al., Boelte, Olgivie et al.). However, this research poses some problems. How can you get more commuters if people feel it is unsafe to bicycle, without having more commuters to make it feel safe? To increase ridership, research has suggested traffic calming measures to slow the traffic down; physically separated bikeways such as bike paths or cycle tracks that will keep bicyclists separated from motorists; and most importantly, more education that will contribute to safer conditions, whether perceived or real (Bauman et al., Boelte, Olgivie et al., and Pucher et al., “Cycling). Good examples of successful designs can be seen in Dutch cycle design and elsewhere throughout northern Europe (Parkin et al.).

Bicycling is safer in northern Europe, especially in Germany, Denmark, and the Netherlands (Parkin et al., Pucher et al., “Cycling,” and Pucher et al., “Making”). One of the reasons for this is that education is of primary importance in northern Europe.

Bicycling is taught at a very young age and is continued throughout the formative years.

Pucher and Buehler further summarized other key policies and innovative measures used in Germany, Denmark, and the Netherlands. The bicycling networks

include extensive systems of separated cycling facilities, intersection modification and priority traffic signals, traffic calming, bike parking, coordination with public transit, traffic education and training, and specific traffic laws intended for the protection of non-motorized transportation. Bicycle networks in northern European countries are multifaceted, available to and utilized by all income classes, genders, and ages with a primary focus on education and safety (Pucher et al., “Cycling” and Pucher et al., “Making”).

The perceptions of my research participants provide insight on the interventions recommended by researchers and those interventions utilized in northern Europe to increase bicycle safety—and ultimately ridership.

Barriers to Bicycle Commuting

Concern for safety is a barrier found throughout the literature, unfortunately, safe conditions are not always present in the United States. Research suggests that a concern for the relative absence and presence of motor vehicles on the route, conditions of the roadway, and a lack of bicyclists on the road are major concerns for safety in the United States, to name a few (Chan, Parkin et al., and Pucher et al. “Making”).

Additional barriers were discussed by Susan Handy and both her colleagues, Heinen and Xing. Handy and Xing focused on the individual decision to commute by bicycle and barriers faced by commuters and potential commuters. Their study of six small U.S. cities found that individual factors such as socio-economic and attitudinal factors, self-selection, social-environmental factors, and physical environment factors

affect riders' choice for commuting. Their survey research led them to conclude that the social environment of the workplace, attitudes, and self-selection are significantly important to affecting the potential to commute. Specifically, the more the employer supports commuting by bike, and the more the commuter feels comfortable commuting, the more likely bicycle commuting will increase. Furthermore, self-selection, as the authors determined, of the physical environment has an indirect impact. "Communities that support bicycle commuting (through both the physical and social environments) may succeed in increasing bicycle commuting within the community more..." (Handy et al. 109). Handy and Xing also found that "perceptions of the attitudes of co-workers towards bicycling, the need to dress professionally, and the orientation of co-workers towards fitness are not associated with bicycle commuting" (107). In contrast to Taylor et al. and Moudon et al., Handy and Xing found that showers and changing facilities—including bike racks—are not a "determining factor for bicycle commuters" (107).

Heinen and Handy, researched similarities and differences between the attitudes and beliefs about the decision to commute in Davis CA and Delft, the Netherlands. They concluded that the Theory of Planned Behavior (TPB) is useful for predicting if one will commute by bicycle or not. They explained that TPB is a consideration of one's attitude towards a behavior, the norms of the social environment, and the perception to what extent the behavior can be performed; they all have an impact on whether individuals will or will not commute by bicycle. "According to the TPB, an individual's attitude towards a behavior is the sum of her various beliefs about the behavior multiplied by the importance she assigns to each belief" (5) "If you have a belief about cycling and attach

importance to it, it becomes a ‘reason’ or motivation to bicycle” (5). Gold interpreted the theory of TPB as a person’s intention that determines their attitude towards the behavior, perceived norms of the behavior, and their control with regards to the behavior.

Essentially, if one has a negative belief about bicycle commuting, or if it is not socially accepted, they are less likely to commute. On the other hand, if one believes that bicycle commuting helps them get in shape, and then they may be more inclined to commute by bicycle, because getting in shape is very important to them.

Handy and her partners gave considerable attention to behavior, social environments, and the attitudes affecting bicycle commuting. Moreover, Heinen and Handy conducted in-depth interviews to develop their results, whereas most research is conducted by quantitative analysis (surveys) rather than qualitative analysis, such as Handy and Xing’s research. This is significant. Not only did Heinen and Handy conclude with interesting results, but they conducted their research with underused methods, exposing a gap in how information is acquired.

Weather, too, is generally hypothesized to be a barrier to bicycle commuting habits. Nankervis conducted a study that presented data on the effect of weather conditions in Melbourne Australia on bicycle commuting. Nankervis questioned the assumption that weather, especially rain, created conditions that made bicycle commuting unfeasible. He found that although weather can affect commuter numbers, supporting the hypothesis, the effect was rather slight. Overall, Nankervis concluded that “neither weather nor climate need be a strong barrier to cycle commuting, and this is in fact the

basis on which the riders surveyed generally act” (430). Dill et al. reaffirmed this. They “doubt that rain is a significant deterrent to bicycle commuting” (3).

There are many barriers to commuting. Which of the barriers previously mentioned are decreasing bicycle commuting and which are not? Which barriers affect my research participants?

Education: What Do I Need to Learn This For?

Literature is clear that bicycle safety education is lacking in the United States (Pucher et al., “Promoting”), creating another barrier. As Wray so eloquently stated, “[p]eople will not do things that do not occur to them or that do not make sense to them” (54). Without the proper education, people cannot understand how to effectively and safely commute by bicycle. Much of the United States’ effort to increase safety through education is focused on the increased use of the bicycle helmet, and unfortunately educational measures are under-researched by the government (Pucher et al., “Making” and United States Department of Transportation Federal Highway Administration). As Pucher and his research colleagues have argued, the Netherlands, Germany, Denmark all have education as a priority. “Dutch, Danish, and German children receive extensive training in safe and effective cycling techniques as part of their regular school curriculum” (Pucher et al., “Cycling” 20). The children have in class and on the road instruction, which they complete by the fourth grade. They are tested by police officers and receive certificates when they pass tests. This “sort of safety education is completely

lacking in the United States. However, the education does not begin and end with the children.

Education extends to motorists. This is a crucial element in cycling safety in the Netherlands, Denmark, and Germany. Motorists are trained "...to be aware of cyclists on the roadway and to avoid endangering them" (Pucher et al. "Cycling" 20). Further, Pucher et al. explained that motorists are assumed responsible for collisions with cyclists and pedestrians, even if they [the bicyclists] are in conflict with traffic regulations. This is not the case in the United States. According to the National Committee on Uniform Traffic Laws and Ordinances in the United States and the Uniform Vehicle Code, a bicyclist is treated with all the same rights and duties as any other vehicle on the road. The California Department of Motor Vehicles states in article 17150: "Every owner of a motor vehicle is liable and responsible for death or injury to person or property resulting from a negligent or wrongful act or omission in the operation of the motor vehicle..." And the law offices of Shulman Dubois LLC clarify how liability is determined, that "in many cases the same laws apply for establishing liability – whichever 'vehicle' operator was negligent and caused the accident will be held accountable for losses" U.S. drivers that collide with cyclists and pedestrians must be proven responsible for the collision. Moreover, drivers are more likely to consider and respect other road users because they were required to take cycling classes during their early school years (Pucher et al. "Cycling").

There are few education programs in the United States and researchers believe an increase in education is necessary (Pucher et al., Taylor et al., and United States

Department of Transportation Federal Highway Administration). The most prominent federally funded program is the Safe Routes to School (SRTS) program. Its aim is to encourage students to walk and bike to school, thereby increasing the safety and numbers of students walking and biking to school (Pucher et al., “Infrastructure”). There are several adult related programs that are more geared towards promoting cycling as an alternative form of travel. However, throughout the research, it is rather difficult to find many adult related safety classes, and only a very few studies have measured the impact of SRTS and other education related programs, resulting in “no observed effect on bicycling” (s113). More research is necessary to not only develop more education programs in the United States, but to determine the impact bicycling related programs may have (United States Department of Transportation Federal Highway Administration). Additionally, this research will provide input on the importance and effectiveness of education.

A Multi-faceted Network

Simply stated, there is no single intervention that will increase bicycle commuting. Research provides evidence that a multi-faceted approach is necessary to increase bicycle commuting (Moritz, Moudon et al., Nelson et al., Ogilvie et al., Pucher et al., United States Department of Transportation Federal Highway Administration).

Several surveys have been conducted that show that cyclists and non-cyclists want multiple interventions (an aggregated or multi-faceted bicycle network); in turn, encouraging them to bicycle more.

Frequently mentioned environmental changes that can encourage cycling included: more bike lanes and trails (mentioned by almost 49% of the respondents), good lighting at night (33%), and bicycle racks at destinations (31%) (Moudon et al. 253).

This sentiment is echoed throughout the available literature. It is through appropriate and aggregated infrastructure that an increase in bicycling will be facilitated (Pucher et al., “Infrastructure”). Moreover, an increase in bicycle infrastructure “positively and significantly correlated with higher rates of bicycle commuting” (Dill et al. 7). More choices equate to some increase in bicycle commuters. “However, bicycle lanes and paths alone are not likely to increase bicycle commuting” (7). The lanes and paths need to have connectivity to major destinations (Dill et al. and Nelson et al.).

Therefore, the question remains: which interventions and measures will be the most effective at achieving such a result? This is a rather difficult question. There are so many interventions ranging from physical infrastructure to policies: on road bike lanes, contraflow bike lanes, shared bus/bike lanes, off-street paths, bicycle boulevards, cycletracks, bike boxes, traffic calming measures, trip reduction and travel awareness programs, Safe Routes to School programs, and Ciclovias (Pucher et al., “Infrastructure”). These are just a few interventions aimed at increasing safety and ultimately bicycle commuting in cities like Munster, Freiberg, and Amsterdam (all with at high rates of bicycle commuting). They all have calmed auto traffic, integrated bike networks, constructed bike paths, improved bicycle signage, and the use of cars is discouraged (Beatley). Pucher et al., found interventions that are designed to separate the cyclists from motorized vehicles were the most popular. Stated preference studies found

both experienced and inexperienced cyclists preferred having separate bike lanes at the very least to riding with mixed traffic because they felt safer. Thus, “researchers hypothesize that if people perceive an increase in safety, they will be more likely to bicycle” (s111). There is no panacea to designing and implementing the most adequate interventions for increasing bicycle commuting, it is rather safe to say that, and Pucher et al. confirmed this, policies and measures to increase bicycle commuting need to be interactive and synergistic, particular to a community and addressing specific needs (safety primarily) of the community.

There needs to be full integration into other modes of transportation, too. “The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) mandates that cycling must be integrated into required transportation plans” (Moritz 91). In the Netherlands and in Denmark, train stations, bus stops and other major public facilities offer numerous spots to park bicycles (Beatley). This provides the cyclists the opportunity to be multi-modal, fulfilling their transportation needs through a variety of options. The varied choices a commuter has to integrate bicycling into one’s transportation plans the more likely they will commute by bicycle. “Substantial increases in bicycling require an integrated package of many different, complementary interventions” that will increase the safety of bicycle commuters and aid in overcoming the various barriers associated with commuting by bicycle Pucher et al., “Infrastructure” s122). An integrated package will differ from community to community. Each package will be contextual and based on the needs and wants of the community. Interviewing bicycle commuters in a community will help determine the most appropriate package

Conclusion

For bicycle commuting to be fully integrated into United States' communities, barriers need to be addressed, and a multi-faceted, well integrated bicycling network should be designed and built.

The research of northern European cities is very useful and the cities are wonderful examples of bicycle friendly cities. They have put in practice several policies and interventions to address barriers, and the need for an aggregated bicycle network. Northern European cities have higher levels of bicycle commuting than the United States. How can the United States increase the levels of bicycle commuting similar to northern European cities?

CHAPTER THREE: EPISTEMOLOGY, METHODS, METHODOLOGY

Introduction

Research on bicycle commuting must continue and be expanded through the utilization of various methods. There are few qualitative studies to analyze, especially those ethnographic in nature. Ethnography, as Pooley described, has been underused in the transportation arena and provides valuable insights into bicycle travel behavior. Much of the research conducted by aforementioned researchers was sourced from secondary sources or surveys of cyclists. Secondary sources and surveys only offer so much information. Quantitative data is important, but qualitative methods add detailed and expansive data to the arena of bicycle research. Qualitative research participants have the opportunity to expand on their perceptions of various bicycling interventions with regards to which interventions will likely increase bicycle commuting in their community. Nevertheless, “ongoing citizen input, especially from bicyclists” is absolutely necessary (Pucher et al., “Infrastructure” s122). Therefore, my research takes a qualitative, ethnographic approach to elicit citizen input on the bicycle interventions they feel will likely increase bicycle commuting. Much like Heinen and Handy conducted their qualitative research, I used in-depth interview questions to collect data on attitudes, perceptions, and knowledge. This is a vital addition to current bicycle research in that it supports the current research and adds to an underused research method.

Epistemology

In order to understand, learn, and develop knowledge from bicycle commuters I employed the theory of standpoint epistemology. Hesse-Biber et al., Gegeo, and Watson-Gegeo argue that standpoint epistemology is rooted in the lives of the researched to create truth and knowledge. Knowledge and truth are not always gathered and understood in the same way. There are many ways to gather knowledge and understand truth (Hesse-Biber et al.). I argue one way truth and knowledge are studied is from research using standpoint epistemology grounded in emic accounts (one studying a culture by participating in the culture) of cultures. Hesse-Biber et al., Gegeo, and Watson-Gegeo argue for the use of standpoint epistemology theory to study cultures from an emic account rather than an etic account (one studying a culture when one does not participate in the culture).

As an avid bicyclist, I am rooted in the community I intend to study. Research participants are bicyclists who commute as I do; there is a symbiotic relationship because we may have experienced similar bicycle commuting situations. I can share my personal experiences and current knowledge of bicycle commuting, while the interviewees reveal their knowledge and insight of past and current bicycle commuting experiences. We shared our experiences and perceptions rather than me extracting those experiences during the interviews. Hesse-Biber et al. explained feminists were “developing knowledge with their research subjects who bring their own experiential knowledge, concerns, and emotions to the projects.” (12). I did the same. The interview process, which is rooted in the lives of the researched, develops knowledge and understanding

from an emic account. Standpoint epistemology is an effective research theory to learn the bicycle commuters' perceptions and knowledge of bicycle interventions.

Methodology

I employed an ethnographic research methodology using interviews of commuters, discussing barriers, concerns, and which interventions are perceived by them to be most likely to increase bicycle commuting. Observing and interviewing the bicycle commuters gave me a primary source for information that structures who these people are and their perceptions of bicycle interventions. Additionally, I have chosen to use ethnography because there are few (e.g. Heinen and Handy, Pooley et al.) ethnographic studies of transportation related issues, especially those related to bicycle commuting. "Ethnographic methods have rarely been used in transport research, though they have been used extensively elsewhere" and will provide valuable insights into bicycle travel behavior (Pooley et al. 450).

As Creswell explains, an ethnographer organizes ethnographic data in a variety of ways by using such methods as surveys, interviews, observations, and document research. I conducted an extensive literature review of bicycle-related research. I searched electronic databases using key words such as bicycle commuting, ethnography, biking, encouragement, commuter, increasing bicycle commuting, active travel, active transport, bicycle promotion, and increase commuting. I used combinations of the words above during my search query as well. I reviewed a variety of academic journals, bicycle related books, government and transportation resources related to bicycle commuting and

transportation in general, and non-profit organizations (e.g. Bicycle Transportation Alliance, Greenwheels, and League of American Bicyclists). I partook in events related to bicycle commuting such as bike-to-work days and alternative transportation committee meetings in hopes of developing relationships with potential gatekeepers (persons that could help me gain access to those I wished to study) and interviewees. I also researched bicycle commuting websites (e.g. bikeportland.org and copenhagenize.com) by reading blog posts and forum comments.

Method

I formulated interviews using open-ended and closed-ended questions that elicited detailed answers. I used semistandardized, informal interview types constructed of essential, extra, throw-away, and probing questions as explained by Berg in Qualitative Research Methods for the Social Sciences. The purpose of this structured interview combination allowed me to follow an arrangement of questions with flexibility, and adjust language based on the interviewees' understanding and comprehension of my research. The 43 interview questions were preceded by an introduction explaining the nature and intended goals of the interview (see Appendix A). A majority of the questions regarding one's perception of various bicycle interventions were based on the interventions defined by Pucher et al. in "Infrastructure, Programs, and Policies to Increase Bicycling: An International Review." Additional questions were formulated from my own barriers and concerns to bicycle commuting. I created open-ended questions to learn the participants' habits and give them ample room to explain their

commuting habits. I interviewed 20 adults from Eureka CA, Arcata CA, Corvallis OR, and Portland OR. I chose these locations because of the proximity to Humboldt State University and for their avid bicycle culture. I felt that 20 interviewees were adequate because, as Patton states, “the validity, meaningfulness, and insights generated from qualitative inquiry have more to do with the information-richness of the cases selected and the observational/analytical capabilities of the research than with sample size” (185). I concluded that 20 participants were a sufficient and lucrative data set when the interview process no longer provided new information. Lincoln and Guba would agree that “redundancy is the primary criterion” for terminating the data collection.

Utilizing the aforementioned epistemology, methodology, and methods, I laid the foundation for research developed by the research participants. The interviewees partook in the research by providing their insights, knowledge, perceptions and experiences that formulated the results.

Initial contact was made to four organizations: Oregon State University (Alternative Transportation Advisory Committee), Redwood Community Action Agency, Bicycle Transportation Alliance, Bigfoot Bicycle Club, Greenwheels, and Mid-Valley Bicycle Club. From there more contacts and interviewees were developed through a snowball effect. I sent e-mails describing who I am, my research project, and interview questions. Contacts at the organizations responded with interest and enthusiasm, and several key gatekeepers have asked for the results of my research. I interviewed the gatekeepers and their suggested interviewees. I negotiated date, place, and time. For the most part I went to the interviewee to make the interview process easier for them.

However, because of the various schedules this proved difficult, especially with regards to those I interviewed at Oregon State University and Bicycle Transportation Alliance (Portland, OR). When I could not travel to meet the interviewees, I utilized the web based video phone system, Skype. This proved to be a very useful tool, saving me time and money associated with long distance travel. I recorded and took detail transcription notes of the interviews.

I did not foresee any potential physical or emotional harm interviewing adults about their perceptions of bicycle interventions and their commuting habits. However, I did anticipate several problems with my research method. I expected the interviews to take 30-60 minutes to conduct. This proved, in very few situations, difficult for the interviewee as their time was not always in abundance. As a result, two interviews were truncated, but completed at a later date. Additionally, I was concerned that the infrequent commuters—and a small number of frequent commuters—would not fully understand the bicycle interventions we were discussing. Therefore, I took additional time to educate them. Overall, these minor problems had no significant effect on the research.

Analysis and Interpretation

After the interviews were completed, I began the analysis and interpretation of the data. There is no panacea to analyzing and interpreting interviews and Riessman agrees. “There is no canonical approach in interpretative work, no recipe and formulas, and different validation procedures may be better suited to some research problems than others” (Riessman 69). My goal was to understand bicycle commuters’ barriers to

commuting and perceptions of various interventions. In order to do so, I focused on the participants to illuminate key issues and see where those issues either conflicted with or supported the research literature. In addition to that, I looked for commonalities and divergences among participants. When I finished data collection I organized the analysis “from analytic insights and interpretations that emerged during data collection” (Patton 378).

I utilized inductive analysis so that “patterns, themes, and categories...emerge out of the data rather than being imposed on them prior to data collection and analysis” (Patton 390). Through the use of summative evaluation I performed a logical analysis of the data. Summative evaluation, as Patton explained, seeks generalizations about “specific interventions on specified populations under specifiable conditions” (156). This allowed me to “cross-classify different dimensions to generate new insights...and look for patterns” among the interviews (411).

I report my results in two ways. First, I explain how the barriers and perceptions of the interviewees contrast the research literature. Second, I report emerging patterns and themes not conveyed in the research literature.

CHAPTER FOUR: RESULTS AND DISCUSSION

This chapter details the key themes that emerged from my research. I provide examples where the participants' responses support the literature, how they diverge from the research literature, and what impact the results have for increasing bicycle commuting. While the twenty participants were open and provided a plethora of information, some results were not discussed because they did not elicit significant findings or develop into major themes. I should note that I never asked the participants if they had any knowledge of safety data regarding specific interventions. I specifically asked them their perceptions; in turn that is what they provided me. Their responses and behavior is based heavily on their perceptions.

For the purpose of this research project I defined the interviewees as either infrequent or frequent bicycle commuters. Commuter types are not static, which is to say that people can move from one type to another over time. Frequent bicycle commuters bike many times a week regardless, for the most part, of time, distance, weather, and perceived concerns for safety. They utilize bicycle commuting as their primary means of transportation. However, they, like the rest of commuters, have specific perceptions regarding bicycle interventions, and they too have concerns and barriers that affect their bicycle commuting habits. Infrequent commuters do not commute by bicycle often. They bike several times a week, but they vary their commuting schedule based on time, distance, weather, and perceived concerns for safety. For example, if time is limited and the distance is too far, the infrequent bicycle commuter will use an alternate form of

transportation: bus, walk, or personal vehicle. More often the infrequent commuter will bike when the weather is to their liking, mostly avoiding cold and rainy days. Interviewee demographics can be found in Appendix C.

The following chapter is divided into subsections. The subsections are used to build the results, each building on the previous. The first subsection argues the concern for safety is perceived rather than real. The second subsection discusses new barriers and how interviewees tier their individual barriers. The third subsection discusses the effects of community support on bicycle commuting. The fourth subsection discusses the necessary improvements for bicycle commuting education. The final subsection assembles the arguments of the previous four sections to highlight the model of the multi-tier approach.

Perceived Sense of Safety

The research is mixed (e.g. Chan, Horton, Taylor et al.) whether concerns for safety are real or perceived. Because of this, I asked participants if they felt bicycle commuting is safe or unsafe. Their perceptions weighed heavily in their responses. Participants were consistent; all felt bicycle commuting is safe, with eighteen participants explaining that the level of safety is dependent on the chosen route, location, or skill level of the bicyclist. Two commuters just stated they thought it is safe without further elaboration. What stood out was that the level of safety was perceived differently by the participants. For instance, two infrequent commuters stated bicycling is safe when they are cautious and obey the laws of the road in addition to assuming that car drivers don't

always see them. Two frequent commuters explicitly stated that commuting by bicycle is safe. This response seems likely given that they also live in communities that support bicycle commuting: Portland and Corvallis OR. Two more frequent commuters stated they feel bicycle commuting is safe, but it is dependent on location and their commuting experience.

These responses, while consistent in some ways, led me to believe the concern for safety is not only perceived, but also contextual, based on location, and one's understanding of the various interventions. Moreover, it is not entirely dependent on whether one is an infrequent or frequent commuter. To make my point more clear, I refer to the interviewees' perceptions of three interventions.

When asked, *What is your perception of on-road bicycle lanes?*, participants held largely consistent views. Using phrases like "feels safer," "I like," and "I do not like," interviewees were describing their perceptions and how that influenced their opinion of the intervention. Interviewee #10, an infrequent commuter, said, "I stay in the bike lane and feel safer." Interviewee #11, a frequent commuter stated, "They should be everywhere. Not enough. They shouldn't be optional." Interviewee #12, an infrequent commuter exclaimed, "feels safer in [bike] lane." Interviewee #19, a frequent commuter, contended, "I like them. I do not like being a part of the flow of traffic."

The interviewees felt being separated from car traffic was the safest option; however, they do feel a sense of safety in the bike lane even though there is not necessarily a physical barrier protecting them from a collision with a car. The

interviewees want separation and proper designation on the road to increase their perceived sense of safety, whether a frequent or infrequent commuter.

This theme continues when the bicyclists were asked, *What is your perception of cycletracks?* “Cycletracks are similar to bike lanes, but are physically more separated from motor vehicles, for example with a curb, vehicle parking, or other barriers” (Pucher et al., “Infrastructure” s109). Ten frequent commuters responded positively regarding cycletracks. Again, their perceptions are prevalent. Interviewee’s #18 answer reflects the others’ sentiment when he stated, “I really like cycletracks better than bike lanes. Having space separated from cars is great because it increases air quality and safety increases. Having physical separation between me and the motor vehicles is comforting.”

Interviewee #4: “Won’t get “doored” or pulled in front of.” Five infrequent commuters responded similarly with responses like Interviewee #7: “I would feel safer. Definitely [a] great barrier from being hit by a car.” Interviewee #9: “That sounds good. More sense of safety.” Interviewee #10: “Sounds safe to ride a bike. A great idea.”

While many interviewees favored cycletracks because they provided a perceived sense of safety, a few interviewees had a negative perception; something that surprised me. Their perceived sense of safety differed from the majority of interviewees.

Interviewee #2 stated, “Hard to get drivers to understand them. Cyclists may jet out into intersection, making it more unsafe for other road users.” Interviewee #3 echoed this sentiment, “Potential bike and pedestrian conflict.” Interviewee #6 continued this thread of thinking, “Concerned that right side of car could still ‘door’ cyclists.” Interviewee #14: “Not sure.” She was concerned with cars opening doors and potential for car passengers

not expecting the biker on the right side of the car. And Interviewee #16: “Hugely negative. Being trapped between cars and curbs gives me the ‘willies’.”

Those that perceived cycletracks as an intervention that increase a sense of safety were a combination of frequent and infrequent bicycle commuters, male and female. Those that perceived cycletracks as an intervention that decrease a sense of safety were all frequent, experienced bicycle commuters, except for interviewee #6. Two are males and three are females. The difference between their answers could be because all of the interviewees are involved in active transportation organizations specific to promoting bicycle commuting and recreational riding. These participants may have had the opportunity to read research literature and discuss negative aspects of cycletracks; in turn, becoming more critical of them. None of the participants lived in a city that had cycletracks, but interviewee #2 knew about them; interviewee #3 has read and studied them; interviewee #6 was not familiar with them and I had to explain what they are; interviewee #14 was not familiar with cycletracks and I had to explain it to her; interviewee #16 does not live in a city with a cycletrack and it was not known if he had used a cycletrack. Their perceptions were contextually based on their knowledge and understanding of the intervention.

The participants’ concern for safety is evident when they were asked, *What is your perception of two-way travel on one-way streets (i.e. contraflow bike lanes)?* Nine interviewees (combination of infrequent and frequent commuters) were generally concerned with safety. They perceived contraflow bike lanes to be unsafe. Interviewee #2 stated, “They make sense in Seattle, but not in Humboldt County. In Humboldt County

most pedestrian and bike collisions are on one way streets.” Interviewee #16 stated, “not experienced with those. I would be hesitant, very concerned that drivers would not expect to see bikes.” Interviewee #14 reported, “Might throw me some. Feels a little unsafe.” Interviewee #13 exclaimed, “Sounds scary. Trying to visualize it.” A combination of infrequent and frequent commuters perceived contraflow bike lanes to be a safe, positive intervention. Interviewee #19: “I like them.” Interviewee #7 explained, “I don’t have a problem. More convenient for cyclists going on one way streets.” Interviewee #12 stated, “Sounds like a nice idea.” Regardless of whether the commuter is an infrequent or frequent commuter, the perception of safety was based on their knowledge of the intervention and how they understood its purpose.

What became clear as participants answered the above question was that they created tiers of barriers to overcome, which led to a decision to commute or not. The first tier for everyone is having a perceived sense of safety. If an intervention—or commuting in general—is not perceived as safe, it is unlikely the interviewee would utilize that intervention to commute. The commuter must feel safe first before considering other barriers. After a perceived sense of safety is achieved, other barriers vary based on the individual and are tiered differently. I discuss the other barriers in more detail in the next section. A good example of an interviewee achieving a sense of safety is seen in regards to contraflow bike lanes. When it comes to safety, participants would utilize contraflow bike lanes in certain contexts as long as they were on low speed roads with low motor vehicle presence. Or, they wanted adequate and appropriate signage for drivers and bicyclists and a barrier separating the bicyclist from car traffic to increase the sense of

safety. Interviewee #8: “I would be receptive to it on a low volume, low speed street.”

Interviewee #1: “It works if there is a barrier so bikes are protected and cars know not to drive in the bike only lanes.” Interviewee #4: “Fine, works great at low speeds.”

Interviewee #17 thinks that contraflow bike lanes “are really excellent ideas. I think they are crucial...needs arrows to be fully effective.” Four infrequent and frequent commuters would perceive contraflow bike lanes safe if certain conditions were met.

Interviewees’ responses changed based on their perceived sense of safety when utilizing an intervention, how they understood it or if they had knowledge of the intervention, and the context of the situation (e.g. having proper signage, low speed street, etc.). Moreover, interviewees unknowingly created an individual system of tiers for barriers to overcome in order to make decisions regarding whether to commute by bicycle. They would perceive an intervention as safe if certain conditions were met that increased their perceived sense of safety, which leads to a decision to commute or not. Commuting experience was not the only factor that influenced their perception, but if they were familiar with the intervention or not, as in the case of contraflow bike lanes. For example, one may have plenty of experience commuting by bike, but have little to no knowledge of a contraflow bike lane and perceive it unfavorably. Conversely, one may not have much experience commuting by bike, but perceive a contraflow bike lane favorably. Thus, it is not the specific intervention that matters so much, but how it is perceived that matters. If a bicycle commuter perceives a bike lane to be safe, then it is a safe intervention to them. Therefore, my previous conclusion still stands: the concern for safety is not only perceived, but is contextual, based on location, and how one

understands the intervention. It is not entirely dependent on whether one is an infrequent or frequent commuter.

Furthermore, commuters develop individual criteria that they perceive will make an intervention safe. Further research is necessary to determine the extent each factor affects commuting habits. It may also behoove planners to consider ways to inform the public of the various interventions and their intended implications before implementing the intervention.

Other Barriers

It became clear that the first barrier to overcome for interviewees in order to commute by bicycle was safety (first tier). If perceptions of safety were met satisfactorily, interviewees demonstrated that they created individual tiers of barriers to overcome next in order to make bicycle commuting viable. Researchers (e.g. Moudon et al., Pucher et al., Taylor et al.) cited a lack of safety, showers and facilities (parking, etc.), and fun when bicycling as significant barriers to increasing bicycle commuting. My research suggests that these are not the only barriers for bicycle commuters. There are other barriers that the interviewees expressed that impact their commuting habits: weights limits and time constraints. Here is a perfect example of the tiering process. The first tier is always attaining perceived safety. Once participants feel safe commuting by bicycle, they create an individual system of tiers for all other barriers. For example, a lack of parking facilities might be the next barrier in the personal tier for a bike commuter. If more parking facilities were installed, it is no longer a barrier. Weight limits and time

constraints might be the next tier of barriers. The question then is how do they overcome these barriers?

Six interviewees cited “weight limits” and “time constraints” as a significant barrier. Four of the interviewees also cited time constraints as a barrier, especially when they had to pick up children, run multiple errands, or attend multiple appointments in a day. Four of the six interviewees were frequent commuters and two were infrequent. Three interviewees cited rain, and lack of parking and showers as additional barriers. The interviewees demonstrated how they created their own tiers of various and personal barriers and developed a process to overcome those individual barriers in order to decide to commute or not.

To overcome these tiered barriers the interviewees used what Karl Weick called sensemaking, specifically problem setting. Weick explains that we use sensemaking or problem setting to cope with interruptions, surprises, or uncertainties that are significant to us. “Problem setting is a process in which, interactively, we name the things to which we will attend and frame the context in which we will attend to them” (9). In other words, individuals frame the uncertainty or problem and then determine the direction to address the problem or change the situation (Weick). Bicycle commuters have utilized problem setting to address individualized tiers of barriers to commuting such as purchasing rain gear to stay dry in rainy weather. But, as Weick contends, they inevitably “find themselves again in a situation of uncertainty” once they have overcome each previously tiered barrier (9). In the case of weight limits and time constraints, bicycle commuters have found themselves dealing with the next tier of barriers, which they may use problem

setting to address. However, the interviewees have not used problem setting to address these barriers. They may have named these barriers, but they have yet to frame the context in which they will address them. I believe the reason for this may lie in their answers to question ten, *What would eliminate or diminish these barriers?*

The interviewees answered that more time or purchasing a trailer to haul more stuff would eliminate their barriers. However, interviewee #4 said that it is not worth investing in a trailer because it is not often that he needs to carry a lot of stuff. The barrier is perceived as too significant to overcome. Interviewee #7 answered that purchasing “proper rain gear” and “breaking down the perceived mental barriers regarding getting to work” would eliminate her barriers, but nothing of needing more time to run errands. She cited rainy weather as her first barrier (first tier) and then not having enough time to run errands throughout the day as her second barrier (second tier). She needs to overcome safety and weather barriers first before addressing time constraint issues. Interviewee #12 said that more time may eliminate the barrier. Using Weick’s process of problem setting, interviewee #16 explained that if his daughter commuted more by bike he would not have to pick her up. He could also buy a trailer, but he too said that it is not often enough that he needs a trailer to carry large loads; buying a trailer is not warranted. This is also an example of tiering. The first tier is the daughter commuting more and the second tier is buying the trailer. Although these are new barriers, I believe that they are significant enough to not motivate the bicycle commuter to overcome them, and that it is rather difficult to appropriate more time in one’s busy life to run errands by bicycle. The interviewees are using the process of sensemaking to overcome their barriers. First, they

address safety concerns, and then address various other barriers, creating a tiered approach. *Only when each person's tiered list is overcome will they choose to commute.* This is the heart of the problem.

Another example of Weick's problem setting can be seen as my research counters the argument of Dill et al. and Nankervis; weather is indeed a significant barrier to the bicycle commuters I interviewed, especially rain. Ten interviewees (both infrequent and frequent commuters) cited weather, rain specifically, as a deterrent to bicycle commuting when asked what their barriers are to commuting. They also mentioned rain as a deterrent when asked what the least feasible trip/activity is by bicycle. This is unexpected not only because it counters the arguments of Dill et al. and Nankervis, but particularly because these interviewees live in the Pacific Northwest where rain is expected many months of the year. Their reasons were not so explicit, but later in the interview process I asked them two questions that illuminated why rain is a barrier: (1) *What would eliminate or diminish these barriers?* and (2) *Is your willingness to commute by bicycle influenced by bike parking or bike storage?*

Overall, the interviewees answered with three different responses. One interviewee did not like dealing with rain gear after it rained and wanted covered parking, three wanted better rain gear and did not want to get wet, and six interviewees wanted sheltered parking. Interviewee #16 tiered his response and expressed his disdain for dealing with rain gear because it is a hassle putting it on and taking it off. He also mentioned that without covered parking at his place of work it would not be enticing to bike to work in the rain. Of the three (interviewees #8, #9, and #14) that wanted better

rain gear I deduced their rain gear is of poor quality and they don't want to ride in the rain and get wet. The six interviewees that mentioned that a lack of sheltered parking affects their willingness to commute seemed concerned with the effects of rain on their bicycles. Interviewee #7, an infrequent rider: "I would want a sheltered spot if it is rainy..." Interviewee #13, a frequent rider: "If I had to park outside without cover, I would be less inclined to ride in bad weather." This may also be a result of rain creating poor riding conditions and therefore increasing a perceived concern for safety when riding. In some ways their wants did not matter, but provided further evidence of problem setting and creating individual tiers of barriers to commuting by bicycle.

Tier building is seen when my interviewees' responses challenged two of Handy and Xing's conclusions. First, Handy and Xing found that "perceptions of the attitudes of co-workers towards bicycling, the need to dress professionally, and the orientation of co-workers towards fitness are not associated with bicycle commuting" (107). I understand this to mean that co-workers' attitudes, dressing professionally, and regardless of how co-workers feel about exercise do not affect whether someone will commute by bicycle or not. Overall, their analysis "contributed to an improved understanding of factors associated with the decision to bicycle commute and help provide a stronger empirical basis for policy, projects, and programs" (92). When asked, *What barriers, if any, keep you from commuting by bike?*, Interviewee #10 was the only one that identified concern with professional dress as one of the barriers to commuting to work. Her job is in a professional office environment where dressing professionally is a requirement of the job. She is an infrequent commuter in the age group of 46-55. She commutes for light

shopping trips or to run errands, but mostly when the weather is fair and she has time. She has created tiers that influence her decision to commute or not. First, she needs to feel safe, but then she tiers her other barriers (i.e. poor weather, having enough time, and dressing professionally)

Second, in contrast to Taylor et al. and Moudon et al., Handy and Xing concluded that showers and changing facilities—including bike racks—are not a “determining factor for bicycle commuters” whether they will commute or not (107). Interviewees were asked, *is your willingness to commute by bicycle influenced by bike parking or bike storage?* Eleven out of the twenty interviewees stated that their willingness to commute by bicycle is influenced by parking or bike storage. Interviewee #11, a frequent commuter, explained

My willingness to commute is influenced by parking and storage. It must be secure. Facilities are a sign of shared commitment between employee and employer. All of it is a positive thing, if designed well. Encouraging it makes for healthy and happier employees.

Interviewee #13, an infrequent commuter: “It would be. If I had to park outside it would be a real drag. If I had to park outside without a cover, I would be less inclined to ride in bad weather.” Interviewee #17, a frequent commuter, proclaimed, “I think the presence of a reasonable quality of bike racks is essential.” Interviewee #18, a frequent commuter said, “Yes. I like indoor parking especially. I like parking to easily lock your bike.

Interviewees were also asked, *Is your willingness to commute by bicycle influenced on whether or not you have showers/changing areas at workplace?* Their answers contradicted Taylor et al., Moudon et al., and Handy and Xing’s conclusions that

showers and changing facilities do not affect bicycle commuters willingness to commute. Five out twenty interviewees stated having showers/changing areas do influence their willingness to commute. Interviewee #3, a frequent commuter: Yes, sixteen miles, I can't ride without sweating. If I didn't have a shower, it would be a barrier." Interviewee #17, an infrequent commuter, said, "It's not currently in my particular job, but in other types it would be."

In sum, there are new barriers (second tier to the safety tier) emerging among bicycle commuters. In contrast to previous research efforts, rainy weather is a barrier, as well as a lack of showers and changing facilities. Additionally, a lack of time and weight limits may deter commuters, but if the barrier is too significant to cyclists or not relatively easy to overcome, they may not be motivated to overcome the tiered barrier. Interviewees are using a tiered approach to bicycle commuting. First tier, they are concerned with the safety, which is perceived. Once they feel it is safe to commute, then they address other barriers (weather, parking, showers, time, weight limits, etc.) in their second tier. Lastly, they look for support from their professional and social community in their third tier in order to make decisions about commuting by bicycle.

Community Support

The tiering system takes shape: Commuters must feel safe, then address other barriers, and then get the support from social and professional communities. It is a process. Interviewee #10 works for a university that supports alternative transportation choices. Showers, parking, and changing facilities are provided. It was not determined if

interviewee #10 knew about the showers and changing facilities, if it is convenient, or if she felt comfortable using the facilities. Additionally, how much the university promotes alternative transportation choices, showers, changing facilities, and parking is not completely known. What is clear is interviewee #10 will not commute to work by bicycle because she is concerned with dressing professionally for work. She does not feel that she is supported from her professional community enough to commute to work and still dress professionally, even though safety and her other barriers have been overcome. This does not entirely counter Handy and Xing's conclusion. What it does say is more research is needed to determine how much professional dress—especially between genders—influences the choice of infrequent commuters working in a professional environment.

However, interviewee #10's concern for dressing professionally does support Handy and Xing's use of Theory of Planned Behavior (TPB). TPB explained one's attitude towards a behavior, the norms of the social environment, and the perception to what extent the behavior can be performed has an impact on whether individuals will or will not commute by bicycle. Essentially, if one has a negative belief about overcoming their tiered barriers, or if it is not socially accepted, they are less likely to commute. Interviewee #10 believes that commuting by bicycle to work does not allow for dressing professionally (a third tier barrier) and therefore will not commute to work by bicycle.

Improving Education

Education is important to increasing bicycle commuting. Bicycle commuting is ubiquitous in European countries. Children are taught to safely and effectively commute

throughout their formative years. However, in the United States, bicycle education is underfunded and underutilized.

It is no surprise that interviewees wanted to see an increase in education for bicyclists. It was consistent among the interviewees that an increase in education was perceived favorably. However, there was only one participant that stated they would not take a class, but still thought that they could benefit from it.

When asked, *What is your perception of bicycle education programs? Would you take a class to improve your skills?*, participants, infrequent and frequent commuters answered positively. Interviewee #5: “They are essential for bikers and non-bikers.” Interviewee #20: “They are especially good for younger riders.” Interviewee #7: “I would take a class. I wish there were more to take.” Interviewee #17: “I would take a class to improve my cycling skills. I think it would be excellent to offer in school as part of the PE program. It can focus on cycling skills and health that can contribute to lifelong well being.” I assumed the participants were positive about education because it provides the rider the opportunity to learn the necessary skills to commute safely and efficiently.

When asked about a specific and well known educational program, Safe Routes to School, all participants agreed that it was a positive program and that it was or would be effective. However, two interviewees were not familiar with the program and needed me to explain it. Interviewees #2, #4, #7 agreed that it is a positive intervention, but that parents need to be engaged so that they continue to encourage and support their children biking and walking to school. Interviewee #7 expanded the thought and wanted to see more classes focusing on the education of adults, and interviewee #8 agreed and wanted

to see the program expanded to high school students. Interviewee #3 answered, “[It’s] great getting people on bikes when they are developing attitudes.” Interviewee #19 elaborated,

I love it. I think that anything that keeps kids out of the house and active is essential. It is very empowering to not have to always ask mom and dad to take them places [referring to the children]. Children have lost that sense of growing up.

Interviewee #20 exclaimed,

That is a good program for opening the conversation up about walking and biking for multi-generation, because the behavior to change, will allow children to walk and bike. If they are given these opportunities more conversation will ensue about how to make it more convenient and efficient for those that don’t usually walk and bike because of distance or concern for safety.

The research literature focuses on promoting cycling education for children, and rarely for adults, and researchers claim that education programs are underfunded (Pucher et al., “Making” and United States Department of Transportation Federal Highway Administration). SRTS promotes active living and safety on the road for children. Adult education courses are lacking and the involvement of parents in their child’s classes is needed. Several interviewees discussed what else education programs are lacking.

Interviewee #5, #14, #16, and #17 stated that they want bicyclists to get the respect as a valid user of the road. Interviewee #5: “The law says I belong there and I want to be there and I have a right.” After reviewing the curriculum for SRTS and Oregon Walk and Bike to School, it was not entirely clear that the students were taught that they have a right to be on the road, and that there is a law protecting this right. Safety

(helmet use, obeying traffic laws) and active living (walking and biking more, especially to school) are the priorities of this program, with the focus on children. According to the Uniform Vehicle Code, “[e]very person propelling a vehicle by human power or riding a bicycle shall have all the rights and all the duties applicable to the driver of any vehicle” (168). This is important to note because it increases the perceived safety of the bicycle commuters; they know they are allowed on the road and will not feel like they are impeding other road traffic.

Additionally, interviewees admitted that they did not understand one or several of the bicycle interventions, and they lacked experience with several as well. This poses significant problems to increasing bicycle commuting. If individuals do not understand various interventions—their implications and uses—or have experience with them, then how will planners successfully increase the number of bicycle commuters with the implementation of certain interventions? Wray said, “People will not do things that do not occur to them or that do not make sense to them” (54). For example, when interviewee #4 (frequent commuter) was asked about his perception of bicycle boulevards he said, “I have no experience with those; I am not sure how to answer.” Interviewee #7 responded (infrequent commuter), “I don’t know what those are,” when asked about her perception of cycletracks. Interviewee #8 (frequent commuter) was not familiar with shared bus/bike lanes. In addition to a lack of familiarity, some interviewees had contradictory understandings of various interventions. Interviewee #3, #4, #16, and #18 (frequent commuters) understood that the purpose of a bike box is to reduce right turn collisions with bicycles and motor vehicles. However, interviewee #6 and #7 (both

infrequent commuters), and #8 (frequent commuter) understood bike boxes to facilitate left turns for bicycle commuters and reduce left turn collisions with bicycles and motor vehicles. This begs the question, how are people getting informed of the various interventions and are the sources of information accurate? Summed up by interviewee #4's conclusion, "Not everyone knows all the interventions... [we should] educate bikers like car drivers." I understood this to mean that there should be an extensive educational requirement and curriculum similar to the mandatory educational requirements and curriculum for motor vehicle drivers.

Education must be done following the tiered approach, and targeting relevant populations in each tier. Education should be utilized at each tier. When the bicycle commuter is moving through the different tiers (Safety-Addressing other barriers-Gaining community support), they should have some level of education reinforcing each tier with resources to move through the tiers easily and efficiently.

The first tier, safety, should educate bicycle commuters and car drivers to be safe users of the road. For example, research focuses on educating the young bicycle commuter. Thus, bicycle education needs to be expanded and taught to not only children, but to adults as well, incorporating parents in order to foster and encourage children to continue biking into their young adult life. Additionally, bicyclists should know that they are legally allowed on the road, afforded all the rights and *duties* of all road users, which may require more extensive or mandatory educational requirements on the part of the bicyclist. Drivers should know that bicyclists are allowed on the road, too. Moreover, education should not solely be focused on riding safely and specific to bicyclists, but

focus on other issues beyond just safely riding a bike (e.g. benefits of active living, entrusting a child to ride alone to school, building awareness of other road users, etc.).

The second tier, other barriers, should educate bicycle commuters how to overcome their various barriers and which interventions can help in that effort. A greater understanding of the interventions should help make commuting safer, fun, and more efficient. The third tier, community support should educate bicycle commuters and car drivers about the benefits of commuting by bicycle, resources to learn more about commuting, and the various incentives to encourage commuting by bicycle to work, to school, and to run errands.

Yes: We Need a Multi-tiered Approach

Up until this point I have discussed a tiered system created by the interviewees. Interviewees demonstrated that they tier their needs that must be met in order to be a bicycle commuter. This tiered system is suggestive of and echoes Maslow's hierarchy of needs, but applied to bicycle commuting. Maslow described a process that human motivations move through to meet certain needs. He used the terms physiological, safety, belongingness and love, esteem, and self-actualization to describe the various tiers of the process. As each tier's needs are met, the individual moves to the next tier until reaching self-actualization. Similarly, a bicycle commuter moves through a tiered system, meeting their needs at each level before proceeding to the next. The tiered system is specific to each person or community. The levels are as follows: safety, other barriers, community

support, and then integrated mobility as a bicycle commuter. Education is at each level providing resources to help move to the next level (see Figure 1).

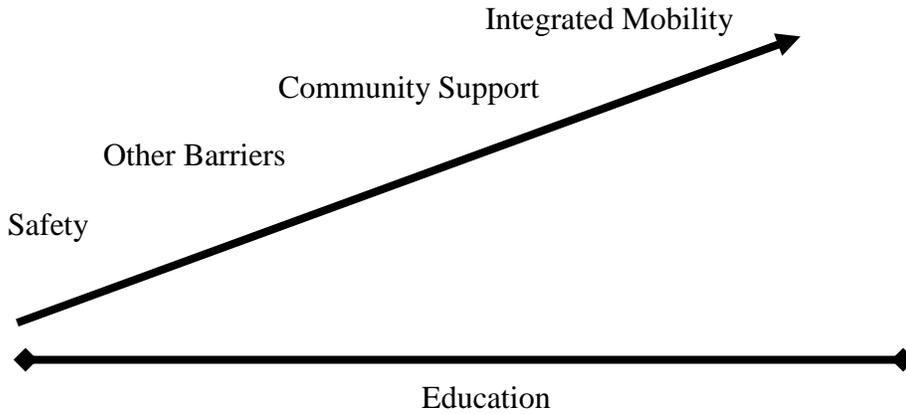


Figure 1

Research suggests that an aggregated bicycle network (based on the European model) has several components that should be prioritized to increase bicycle commuting in the United States (Dill et al., Moritz, Moudon et al., Nelson et al., Ogilvie et al., Pucher et al., United States Department of Transportation Federal Highway Administration). The network may look like this: Tier One (Safety): bike lanes and bike paths that are connected to major routes and destinations and separated from traffic; Tier Two (Overcoming Other Barriers) Traffic calming, ample bike racks, coordination with public transport, etc; Tier Three (Community Support): acceptance of bicyclists as valid user of the road and a bicycle as a valid form of transportation. It is necessary to educate bicyclists and car drivers throughout the process. Because bicyclists are legally allowed on the road, afforded all the rights and *duties* of all road users, there should be an

extensive educational requirement and curriculum similar to the mandatory educational requirements and curriculum for motor vehicle drivers. This will eventually lead to the final tier (integrated mobility), where the bicycle commuter and the community realize the full potential of the commuter and the act of bicycle commuting.

United States Department of Transportation Federal Highway Administration concluded that “no single improvement will be sufficient to attract all potential bicycle commuters to cycle, and that some sort of integrated approach is the best bet for stimulating mode shifts” (24). It is evident that with so many varying degrees of commuter styles, multiple needs and concerns, and various bicycle interventions that a multi-tier approach—that follows the tiered approach that people appear to utilize based on my data—is necessary in order to increase the number of bicycle commuters. Pucher et al. wrote in “Making Cycling Irresistible: Lessons from The Netherlands, Denmark and Germany” that “[m]any policies and programmes are necessary to make cycling safe and feasible for a broad spectrum of the population” (510). They further explicated that the Dutch, Danish, and German model for an aggregated, multifaceted approach to increasing bicycle commuting is the recipe for success. But which interventions are best? For whom is the network designed? Is the European model the right model for the communities and the participants I interviewed?

Infrequent commuters, which were mostly female, cited bike lanes and bike paths frequently as the most important interventions, stating that they provide more separation from traffic and an increase sense of safety. In fact, interventions that provided separation were the most important to this group. They also wanted to see more educational

opportunities made available for children and adults. Frequent commuters, which were pretty evenly divided between female and male interviewees cited bike lanes, too, but were more diverse in their answers. They emphasized multiple interventions such as cycletracks, bike boulevards, traffic calming, and an increase in educational opportunities. Frequent commuters cited bike parking as important, but preferred covered bike parking. This made sense because of the amount of rain the Pacific Northwest gets each year and the high temperatures that Corvallis and Portland OR get during the summer months. Interviewees do not want wet bikes or scorching handle bars and saddles. In addition, four of the frequent commuters wanted to be respected as valid users of the road.

Infrequent commuters advocated for interventions that provided separation from motor vehicles and an increase in education, promoting a sense of safety. Frequent commuters were concerned with increasing the same things as infrequent commuters, but they emphasized a more diverse network: requesting traffic calming, adequate bike parking (preferable covered), and bike boulevards. Planners should not ignore frequent commuters' requests or perceptions; they are extremely valuable. However, they already and have been commuting for some time. It may be more beneficial to focus on the infrequent commuters, especially female. There are fewer females commuting by bicycle than males (Pucher et al. "Cycling", United States Department of Transportation Federal Highway Administration, and Winters et al.). Planners that focus on turning infrequent commuters to frequent commuters may succeed more rapidly at increasing the number of commuters in a community. Planners should focus on interventions that provide

separation from motorists (bike lanes, bike paths, cycletracks), educational opportunities, and increasing the perceived sense of safety. And to do so, planners should consider a multi-tier approach to meeting the needs of bicycle commuters.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

Increasing bicycle commuting in the United States is a perpetual challenge. I want to see more bicycle commuters on the roads for environmental, economic, and health reasons. Most importantly, I want to see more communities biking because it is fun, safe, and a wonderful social activity. I hope this research will help that effort. My aim was to analyze and review several interventions (e.g. bike lanes, bike parking, education programs, traffic calming, etc.) presented in research for increasing bicycle commuting. In doing so, I employed ethnography as my research methodology. Through the use of interviews, I identified some of the interventions bicycle commuters perceived as the most ineffective or effective for increasing bicycle commuting. Rooted in the lives of the research participants, the interview process developed knowledge and understanding from an emic account (one studying a culture by participating in the culture). From this, I answered the question: What are bicycle commuters' perceptions of the interventions presented in research literature? As a result, I developed a model for dealing with how to approach which interventions to implement in a community. Using the multi-tiered approach may help to determine which interventions are perceived by bicycle commuters to most likely increase bicycle commuting, and assist planners in developing appropriate interventions for their community. Each commuter will systematically progress through the tiers.

Current research literature debated if the concern for safety is perceived or real, how to increase safety when commuting by bicycle, several barriers to bicycle

commuting, the lack of bicycle education in the United States, and the need for an aggregated bicycle network to increase bicycle commuting. Researchers argued that in order to increase the safety of bicycling in the United States that planners need to adapt the model utilized by the Netherlands, Germany, and Denmark. Furthermore, research contended that a concern for the relative absence and presence of motor vehicles on the route, conditions of the roadway, and a lack of bicyclists on the road are major concerns for safety in the United States, to name a few. With regards to barriers, Handy and both her colleagues focused on the individual decision to commute by bicycle and barriers faced by commuters and potential commuters. Their research led them to conclude that the social environment of the workplace, attitudes, and self-selection are significantly important to affecting the potential to commute. They also concluded that the Theory of Planned Behavior (TPB) is useful for predicting if one will commute by bicycle or not. Dill and Nankervis found that weather is not a strong barrier to bicycle commuting. Researchers further suggested that education is lacking in the United States and that it is necessary to increase educational opportunities. Pucher et al. went as far to say that the educating bicyclists needs to start at a young age and be extended to the motorists, particularly similar to how northern European countries have educated drivers and bicyclists. Lastly, research concludes that an aggregate, multi-faceted bicycling network is necessary to increase bicycle commuting on a large scale in the United States.

My research has added to current research in many ways. First, it has shown that safety is largely perceived. Second, it has revealed new barriers and how interviewees tier their individual barriers. Third, it discussed the effects of community support on bicycle

commuting. Fourth, it provided the necessary improvements for bicycle commuting education. Lastly, it developed a model based on Maslow's hierarchy of needs. The model compiles the previous additions to highlight the need of the multi-tier approach.

Additional research is necessary to determine the most effective ways to increase bicycle commuting. Current research shows that addressing issues of perceived safety, increasing shower and changing facilities, increasing education, providing interventions that are separated from motor vehicle traffic, and building a bicycle infrastructure that is made up of many different interventions will increase bicycle commuting. However, which interventions are necessary, what type of education, and where the best places to put showers and changing facilities is in need of answering. It is a complicated problem that changes from community to community. The multi-tiered approach will help in the effort to identify which interventions are best and what type of education is necessary. Moreover, imploring more qualitative research will aid in this effort. Speaking directly with the public helps specify the type of bicycle network they want in their community. The public will have ample opportunity to express their needs and concerns in detail.

My research sought to ascertain the interventions that would be likely to increase bicycle commuting. This was a difficult task. Some interventions (e.g. cycletracks, bike paths) were favored among the interviewees. However, I found it easier to pinpoint the interventions that individuals did not like (e.g. contraflow bike lanes) and the barriers that prevented them from commuting (e.g. weather, weight limits). Further research may conclude the extent that certain barriers, especially those related to the workplace (e.g.

...dressing professionally), are affecting commuting habits. Fresh research may also develop new interventions that may help overcome these barriers.

Furthermore, I suggest supplementary research focus on one type of commuter group at a time. It is necessary to interview both infrequent, frequent, and non-commuters. Each group has important information to impart on researchers. However, in order to achieve adequate and detailed results, it will behoove researchers to focus on one group at a time.

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APPENDIX A- INTERVIEW QUESTIONS

Introduction:

Thank you for taking time to partake in this interview.

My name is Michael Conway. I am a graduate student at Humboldt State University in California conducting research on bicycle interventions (e.g. bike lanes, bike parking, education programs, and traffic calming, etc)

The goal of this interview is get your perceptions of several bicycle interventions (e.g. bike lanes, bike parking, education programs, and traffic calming, etc) that you feel will be the most ineffective or effective for increasing bicycle commuting. The results of this research will assist organizations concerned with bicycle commuting by offering public input for which interventions may be the most ineffective or effective in their community. Determining which interventions are perceived by bicycle commuters to be most likely to increase bicycle commuting will assist planners in developing the most appropriate interventions for their community.

There are no wrong or right answers to these questions. If you do not understand a question or term I am using, please let me know. I will define and explain any terms you may not understand.

I will treat your answers and identity confidentially. You will be referred to in my thesis as interviewee 1 or 2 or 3, etc.

The interview will take about 30-60 minutes.

Would it be okay if I record the interview so that I may listen to it?

Do you have questions before I start?

Interview questions

1. What city do you live in?

2. Are you male or female?

3. What age group do you associate yourself with?

18-25 26-35 36-45 46-55 56-65 66 and above

4. What is your annual household income level?

Less than \$10,000

\$10,000-\$19,999

\$20,000-\$29,999

\$30,000-\$39,999

\$40,000-\$49,999

\$50,000-\$59,999

\$60,000-\$69,999

\$70,000-\$79,999

\$80,000-\$89,999

\$90,000-\$99,999

More than \$100,000

5. How do you commute most of the time (select one)?

Walk Bicycle Bus Carpool (two or more per vehicle)

Personal Vehicle

Other _____

6. Do you use additional modes of transportation (select all that apply)?

- Walk Bicycle Bus Carpool (two or more per vehicle)
Personal Vehicle

Other_____

7. Do you commute by bicycle for utilitarian purposes (e.g. to work, to school, or shopping)? How many times per week? Per month? Per year? Do you use a bike for any purpose? (This is how I will define if the interviewee is a commuter or not and what type) If no, answer the next two questions. If yes, move on to the third question.

8. What barriers, if any, keep you from commuting by bike?

9. Have you commuted or run errands by bicycle in the past? Describe your experience?

10. What would eliminate or diminish these barriers?

11. What type of trip/activity do you believe is most appropriate [for you] by bicycle? (e.g., commuting to work and school, grocery shopping, running errands). What type of trip/activity do you believe is not feasible [for you] by bicycle?

12. How far do you commute on a daily basis? What distance do you consider the maximum you would travel by bicycle?

13. What would influence you to shop for goods and services in your city by bicycle?

14. What is your perception of on road bicycle lanes?

15. What is your perception of two-way travel on one-way streets (i.e. contraflow bike lanes)?

16. What is your perception of shared bus/bike lanes?

17. What is your perception of off street paths?

18. What is your perception of bicycle boulevards?

19. What is your perception of cycletracks?

20. What is your perception of bike boxes?

21. What is your perception of traffic calming? A combination of physical measures that reduce the negative effects of motor vehicle use (e.g. speed bumps, reducing speed limits, etc).

22. What is your perception of a car-free zone?
23. Is your willingness to commute by bicycle influenced by bike parking or bike storage?
24. What is your perception of a general bike stand (unsheltered) to lock your bike to?
25. What is your perception of a sheltered parking spot?
26. What is your perception of a guarded parking spot?
27. What is your perception of a bike locker to store your bike?
28. Is your willingness to commute by bicycle influenced on whether or not you have showers/changing areas at your workplace?
29. What is your perception of short term bike rental systems such as the one in Paris, France?
30. What is your perception of trip reduction programs? For example, if you commuted by bike, you would get excused from toll fees, parking rates, etc? If your workplace had a monetary reward program (e.g., gift certificate to local business, free bus passes) for bike commuters, would you be more inclined to ride a bike to work?
31. What is your perception of travel awareness programs (advocacy campaigns to reduce driving and increase use of transit, walking, bicycling)?
32. What is your perception of the Safe Routes to School program?
33. What would influence you to let your children commute to school by bike?
34. What is your perception of bicycling specific programs or bicycle promotions such as Bike-to-Work Days, film festivals, or recreational biking events?
35. What is your perception of bicycle education programs? Would you take a class to improve your cycling skills?
36. What is your perception of the safety of bicycle commuting? Do you feel it is unsafe or safe to commute by bicycle?
37. Would you be more inclined to take more bicycle trips if there were more bicyclists on the road?

38. Is your willingness to commute by bicycle influenced by the maintenance of pavement quality or presence of debris on the bike path or road?

39. Do you think your federal, state, or local government is making an effort to promote and facilitate an increase in bicycle commuting?

40. Could you tell me which interventions we discussed are the most important to you?

41. What would influence you to commute by bicycle?

42. What influences you to continue to commute by bicycle?

43. Is there anything else you would like to add? Do you have any questions?

APPENDIX B- INTERVENTION DESCRIPTIONS

These are the descriptions of the specific interventions I referenced in chapter four. These definitions, among others, are found in “Infrastructure, Programs, and Policies to Increase Bicycling: An International Review” by Pucher et al.

On-road bicycle lanes: In the US, bicycle lanes are usually designated by a white stripe, a bicycle icon on the pavement, and signage. The lanes are on each side of the road, to the right of motor vehicle lanes, and are recommended to be at least five feet wide.

Contraflow bike lanes: allow bicyclists to travel in the opposite direction on one-way streets.

Share bus/bike lanes: Bus-only lanes, usually in downtown environments, that allow bicycle travel.

Off-street paths (bike paths): Off-street paths are paved and separated from motor vehicle traffic. They usually accommodate two-direction bicycle traffic. The minimum recommended width is 10 feet.

Bicycle boulevards: Bicycle boulevards are signed bicycle routes, usually on low-traffic streets, that also include other traffic calming features that discourage motor vehicle

traffic, such as speed bumps, diverters and traffic circles.

Cycletracks: Cycletracks are similar to bike lanes, but are physically more separated from motor vehicles, for example with a curb, vehicle parking, or other barriers.

APPENDIX C- INTERVIEWEES' DEMOGRAPHICS

Infrequent Commuters

- Interviewee #1: Female, 26-35 years of age, 10k-19k as an annual income
- Interviewee #6: Female, 18-25 years of age, less than 10k as an annual income
- Interviewee #7: Female, 26-35 years of age, 10k-19k as an annual income
- Interviewee #9: Male, 46-55 years of age, 20k-29k as an annual income
- Interviewee #10: Female, 46-55 years of age, 90k-99k as an annual income
- Interviewee #12: Female, 36-45 years of age, more than 100k as an annual income

Frequent Commuters

- Interviewee #2: Female, 26-35 years of age, 20k-29k as an annual income
- Interviewee #3: Male, 46-55 years of age, 70k-79k as an annual income
- Interviewee #4: Male, 26-35 years of age, 80k-89k as an annual income
- Interviewee #5: Male, 66 plus years of age, 30k-39k as an annual income
- Interviewee #8: Male, 36-45 years of age, 90k-99k as an annual income
- Interviewee #11: Female, 56-65 years of age, 80k-89k as an annual income
- Interviewee #13: Male, 56-65 years of age, 40k-49k as an annual income
- Interviewee #14: Female, 46-55 years of age, 50k-59k as an annual income
- Interviewee #15: Male, 66 plus years of age, more than 100k as an annual income
- Interviewee #16: Male, 46-55 years of age, more than 100k as an annual income
- Interviewee #17: Male, 46-55 years of age, 70k-79k as an annual income
- Interviewee #18: Female, 26-35 years of age, 70k-79k as an annual income
- Interviewee #19: Female, 46-55 years of age, more than 100k as an annual income
- Interviewee #20: Female, 36-45 years of age, 30k-39k as an annual income