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CHANGING CAR CULTURE: A CASE STUDY AT BINGHAMTON UNIVERSITY

BY

DANIELLA MADUBUIKE

BA, Binghamton University, 2017

MA, Binghamton University, 2018

THESIS

Submitted in partial fulfillment of the requirements for  
the degree of Masters in Geography  
in the Graduate School of  
Binghamton University  
State University of New York  
2018



Accepted in partial fulfillment of the requirements for  
the degree of Masters in Major  
in the Graduate School of  
Binghamton University  
State University of New York  
2018

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## **Abstract**

Binghamton University has a parking problem fostered by the car culture of today. A change in car culture through the shift from single occupancy driving towards higher occupancy transit was identified as a possible solution. An online survey was used to acquire students' opinions and thoughts on the issue. Its 824 responses highlighted variables that were grouped into five overarching themes: Convenience, Quality of Transportation System, Satisfaction with Parking, Comfort with Carpooling, and Perceived Benefits and Drawbacks, which were analyzed under different qualitative and quantitative methods to test for their effect on car culture. Qualitative analysis was conducted using R and SPSS to run Chi-square tests and linear regression models, whilst qualitative analysis was conducted using NVivo to run coding and word frequency queries. These results showed trends in student behavioral intentions, providing the understanding needed to promote initiatives to instigate car culture change and potentially reduce the parking problem.

## **Dedication**

For Michelle, Stephanie, Ugo and Emmanuel. For me.

## **Acknowledgements**

First and foremost, I would like to thank Mark Reisinger, who has guided and assisted me throughout the duration of this thesis. For the five years I have known Mark, he has served as a truly invaluable advisor and friend; and is one of the highlights of my undergraduate career. I would also like to thank the members of my committee, Wan Yu and Qiusheng Wu, for serving as reliable resources and guides through my qualitative and quantitative analyses. Lastly, I would like to thank the Transportation and Parking Services for the facilitation and dissemination of my survey. To my family and friends, your guidance and support held me through this difficult process. I cannot thank you all enough.

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## **Chapter 1: Introduction**

An attachment to cars has been on the rise since the creation of the Ford Model T in the early 1900's, and has since become a part of our everyday culture. Our society has become car-dependent with a car culture that focuses on single occupancy driving. This culture has begun to place pressure on parking in large institutions like universities, as it causes inequality in the supply and demand of the limited parking resources. According to the National Center for Education Statistics, the total undergraduate population increased by 31 percent from 13.2 million in the year of 2000, to 17.3 million students in the year of 2014. It is also expected to increase by 14 percent from 17.3 million to 19.8 million students between 2014 and 2025 (National Center for Education Statistics, 2017). Without a change to the current car culture, this wide expansion and increase in population could further increase the demand and supply gap in parking across university campuses, which is already one of the most troublesome transportation problems (Alshuwaikhat & Abubakar, 2008; Balsas, 2003; Shang, Lin, & Huang, 2007). Envisioning a time when people are not as dependent on single occupancy driving, and more reliant on alternative forms of mobility, this research aims to analyze potential ways to change car culture. With parking shortages becoming more prevalent, a commonly suggested solution would be the construction of more parking spots. Although, other than excluding environmental and financial factors such as the loss of green space, and the estimate cost of 2,000 dollars to create a single parking spot, this does not take into consideration the concept of induced demand, which is the phenomenon that after a supply increase, more of a good is consumed.

Therefore, the addition of parking spots only serves as a temporary fix, before the demand for parking increases once again. Taking a more sustainable approach, this research will view the parking problem not as one of availability, but as one of utilization. It will incorporate the potential for other mobility options like public transit and carpooling provide alternatives to single-occupancy driving, as well as estimate and analyze the potential success of these options. Its aim is to evaluate, from a prospective point of view, a change in car culture from one based on single-occupancy driving towards a higher-occupancy based system.

The concept of changing car culture is one that can be applied in various disciplines of planning, design, architecture, policy, and government. Its significance will not only be important to the future of Binghamton University, but could also be utilized by other universities as a model towards regulating their own transportation and parking systems. Also, since car culture is individual-based rather than location-based, students will have the same car culture they have on university campuses, at home as well. Therefore, this form of research and its methods will also be useful to planning agencies and municipalities in the making or updating of transportation plans. It could also make contributions to published literature because so far, a good deal of scholarly work in this area has either analyzed university parking problems (Shang, 2017), the utilization of other transportation options such as carpooling as alternative mobility options (Moshe, 1977) and transit-related behavioral trends (Golob, 1974). This research will contribute a combination of these, including the potential for use of location data in travel demand modeling.

## **Chapter 2: Literature Review**

### **2.1 Transitions from the Age of the Automobile to Smarter Urban Mobility**

In the 1920's, nothing affected American everyday lives more than the automobile. Though invented in the 19th century, the Age of the Automobile was brought into light by Henry Ford with the Ford Model T leading the trail. By 1920, there were eight million registered car drivers, which almost tripled to 23 million at the end of the decade. The car was a part of everyday modern life, shaping mobility and access. This car boom brought along with it any social effects and changes, as it introduced a new and unaccustomed level of freedom in lifestyle. People could travel from rural to urban areas easily, and teenagers could gain much more independence away from home (McKnight, 2015). Although, with these advantages, came new drawbacks of traffic, accidents and fatalities, for the American people. But as one would have imagined, the good outweighed the bad, and the automobile continued to soar. Between 1970 and 2000, the number of cars on the roads tripled, symbolizing this unprecedented triumphal advance of the car (Stampfl, 2016). After years of the automobile being a guiding symbol of urban planning, other means of transportation such as bicycle, bus, and train, have begun to sprout up and legitimize themselves.

### **2.2 The Car as a Symbol**

Since the car boom in the United States, car culture has grown through time as a result of the advancements in technology, and the desire for, and susceptibility of, consumers to this (Graves-Brown, 1997). The car was once mainly for instrumental use

and factors related to its such as speed, flexibility, and convenience. Although, with the up rise of certain motives such as feelings of sensation, power, superiority and arousal, this machine became a cultural icon, status symbol, and a host of symbolic and affective functions. Steg (2005) conducted two studies to identify these functions. The first measured attractiveness of car use aspects, functions of car use, attitudes towards car use and car use overall, to show the effects of the model of material possessions. The second study focuses on how these variables contributed to the explanation of car use as a whole. Social psychology was used to test for instrumental motives based on attitudes proposed by the theory of planned behavior, and symbolic motives based on social comparison theory. Based on these findings, the three categories of car use were distinguished as instrumental(convenience), symbolic (self-expression), and affective (emotions).

### **2.3 Travel Behavior**

This irony of car culture is the portrayal of a sense of power and community with a machine that is more restricting than liberating, which promises freedom but removes rootedness (Graves-Brown, 1997). Our conflicting desires of social interaction create a paradox in which our haste to catch up with technology blinds us from the real world, and our desire for increased connectedness leads to increased alienation. The effects of car culture turn what could be a connecting way of life, to one that limits and separates us. The new ideology of independence should be the ability to travel anywhere freely without the responsibility of a car to keep to. This blueprint for a new form of urban mobility is beginning to depict itself through carpooling (Stampfl, 2016). Large institutions like universities have shown to be prime locations for travel behavior change programs due to

the pressures faced in these institutions to mitigate the effects of traffic. Cooper (2003) discussed the strides that were made towards a change in travel behavior at Monash University in Australia, through the introduction of a TravelSmart trial. It focuses on the methods used for the trial, the pilot programs used for the process, methodology steps in data collection. Results highlighted the importance of the use, usefulness and importance of proposed incentives in travel behavior change, but also highlighted the need for more work to refine the use measurements of transport modes, and a greater degree of university involvement and dedication to strengthen this particular travel behavior change and general change in car culture (Cooper, 2003).

#### **2.4 Millennials and the Changing Car Culture**

Millennials are those born in between the years of 1977 and 2000. They are frequently referred to as the ‘the next great generation’, and are beginning the roll towards a new way of living. There has been a wide shift in the way teenagers do things now, in respect to how teenagers did things in the 19th century. This particular shift is evident in the view on cars and car culture. Studies show the millennials now get licenses later and have less of an urge to obtain them. Also, they drive less, and wait longer to make their first car purchase, which usually, is an already used car, as most would rather save cost to direct the rest of their disposable income towards other portable technologies and gadgets like phones. In general, studies also show that Americans are buying fewer cars, driving less and also getting fewer licenses as the years go by. In earlier years of automobile travel, for a millennial, a license meant liberation from parental control and was a ticket to the open road, but today, only half of millennials bother about getting a license at age 18 (Williamson, 2015). The times



when teenagers used cars to find friends are long gone, as a result of social media, and they can now get to where they want with on-demand transport services. Mark Lizewskie, the executive director of the Antique Automobile Club of America Museum, says how the emotional meaning of the car for teenagers was transferred to the smartphone, and how “Instead of Ford versus Chevy, it’s Apple versus Android, and instead of customizing their ride, they customize their phones with covers and apps,” (Williamson, 2015, p.2).

## **2.5 Influence of Demographics on Car Culture**

Gender is a key and important factor in analyses because circumstances and cultural conditioning have caused different genders to be subjected to different experiences, thereby reacting differently to certain events (Walsh, 2010). In this context of car culture, gender and auto mobility have gone through the stages of early years of the automobile, consumerism and the great economic boom and sexual equality in modern times. Gender differences exist in travel behavior, and can be determinants of overall car culture. Burns (1996) used Metropolitan Phoenix as a case study to analyze the creation of such a culture, and the consequences of these choices in travel behavior. Focusing on landscape and adjacent land uses, an analysis of mobility processes was carried out to understand travel behavior relative to a general location. Disparities were seen between employed women and men in travel patterns and distance, as employed women made more trips for children’s needs and social purposes, structuring their decision-making around childcare and household (Burns, 1996). Carpooling, in this context, would have a different effect on different genders because it would be more difficult for women to change their community choices. According to Walker (2000), gender differences exist within car culture,

especially in relation to masculinity and road safety. Cultural constructions of masculinity forge the attachment they have with car culture that emphasizes their masculinity. This puts them at a greater risk of accidents accompanied with driving, and it has been recognized that men are involved in more car accidents than any other gender group (Walker, 2000). Although, it is paradoxical that even though this difference is noticed, it is not seen in laws and policies. A systematic change in car culture could help to incorporate this differences, while also alleviating the inequality in road safety associated with genders.

## **2.6 Carpooling Defined**

Carpooling is a type of ride-sharing, which is focused on only sharing a car. Carpooling does not have a concrete definition, but the main idea can be conveyed in different ways. It can be defined as “two or more persons, not belonging to the same household, sharing a trip, or a part of it, with the passengers contributing to the driver’s expenses” (Ciari, 2012, p.3). Similarly, according to Commuter Connections, a regional network of transportation organizations, carpooling is “when two or more commuters ride together in a private automobile on a continuing basis, regardless of their relationship to each other or the cost of sharing agreements.” (“What It Is”, 2015, p.1)

## **2.7 University Carpooling Systems**

### University of California Berkeley

UC Berkeley offers a private ridesharing service for students called Zimride. Zimride offers a carpooling program which allows students to purchase a parking permit with a level of lot access. The level of lot access is determined by the number of carpooling permits

present. Two carpoolers receive the regular lot level pass, whereas two or more carpoolers are entitled to the highest level pass. The university also creates the opportunity for students and faculty to carpool together. As described the university's carpooling website, carpooling is a great way to cut driving costs and also reduce stress overall. The university's website describes the quick step process of carpooling as getting a discounted carpool permit and then finding a partner. As an incentive, the university also offers designated and reserves carpool parking spaces throughout campus, which are given on a first-come, first-serve basis and are available to all those in the carpooling program.

#### Stanford University

Stanford University advertises their carpooling program as a great way to get to and from campus. It saves money, reduces pollution, and also enables carpooling passengers to arrive at their destinations refreshed. To be eligible for this program, carpoolers must meet some of the internal criteria set by the university, and must also live within a reasonable commute, which is in line with the goals and intent of the program. In the program, two or more eligible carpoolers sign up for a permit, become members, and then receive a carpool credit payment each month of carpool eligibility. According to the university's website, it also offers incentives such as premium reserved carpool-only parking space and free daily parking permit per eligible carpool member each month.

#### Humboldt State University

This is a university based in Southern California which has about 9,000 students (2015). Humboldt offers carpooling incentives in the form of "Preferential Parking" whereas

students with three or more (unless two passengers is the car maximum) occupants in their car get a preferential parking pass which allows them to park at metered parking spots.

### **Chapter 3: Study Area**

This study is based at Binghamton University, State University of New York at Binghamton, which is located along NY 434 and close to NY 17 and NY 81 in suburban Vestal, New York. A public research and doctoral degree granting institution, the university has over 17,000 undergraduate and graduate students, and plans to exceed to 20,000 students by year 2020. With fifty-one percent of students living on campus, and forty-nine percent of students, the current and projected expansion, has caused an increase in the influx of people into the campus, thus heightening the demand for parking services. Binghamton University has a variety of parking options, which are designed to support and cater to students, faculty, staff and visitors. The campus map in Figure 3.1, illustrates the various parking lots and services offered by the university.

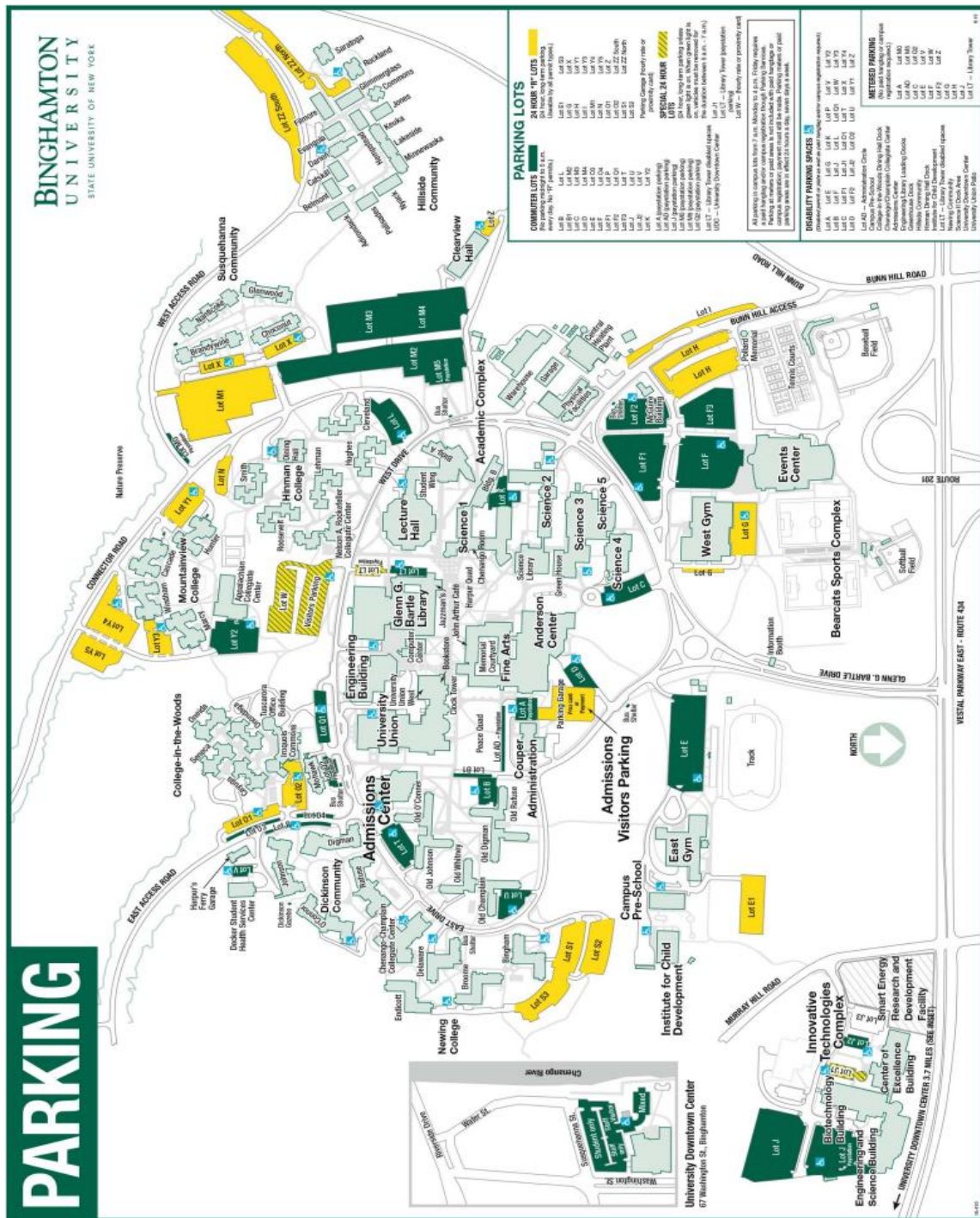


Figure 3.1: Binghamton University Campus Parking Map  
 Source: Binghamton University Transportation and Parking Services

The main campus area has 43 parking lots, with 24 commuter lots and 19 24-hour lots. There are 7,283 parking spaces on campus, with 6,426 spaces for permit use and 857 spaces paid by meters (Abramowitz, 2018). In detail, there are 3,284 commuter and staff spaces, 2,357 24-hour spaces and 1,642 spaces for other uses (state and service, disabled, motorcycled and reserved (Abramowitz, 2018). Also, as of 2018, the annual fee for a parking permit is \$140.55 for students and \$25.00 for faculty.

Also, transportation within and around campus is mainly by bus and is student-owned and operated. Within campus, there are campus shuttles that run to transport students to/from various locations within campus. On the other hand, off campus transportation is run by OCCT (Off Campus College Transport), which transports students to local neighborhoods in the Greater Binghamton Area and other popular grocery and mall destinations. This off campus transportation is also supplemented with city buses run by Broome County Transit, which are available to all students for free and also transport students to the Greater Binghamton Area, as well as a wider scale and range of destinations. Binghamton University offers some alternative transportation options to make getting around campus quicker, easier and more convenient. The university has a partnership with Zipcar which provides the option of car-sharing to students. There is also a bike share program which offers free bikes to students and faculty to commute around campus, and a cab service offering various cab companies that service the university. With all these alternative options available, the steadfast existence of a parking crunch on campus is a problem, one that can be linked to car culture.

## Chapter 4: Conceptualization of Factors that Influence Car Culture Change

To analyze car culture, the main components and variables that it is composed of, must be highlighted and understood. The conceptual framework shown in Figure 4.1 is descriptive of the distributive structure of components and sub-components that this research will follow. The two main variables that affect car culture are Individual characteristics which are specific to each individual, based on their inherent background and character, or earned over time, and the environment, which we have little to no control over, but live according to.

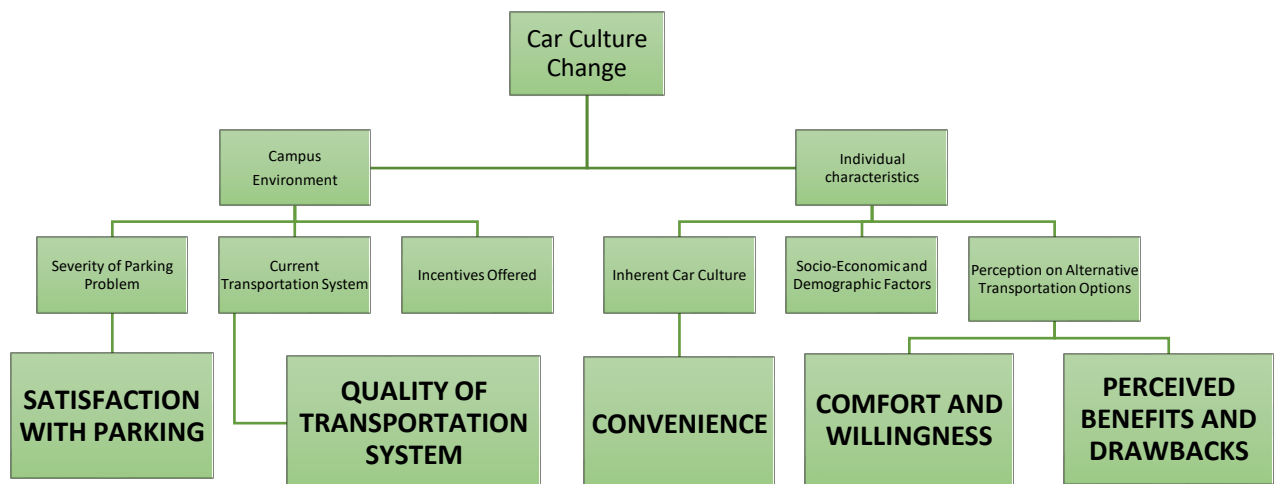


Figure 4.1: Conceptual Diagram

To form the sub-components of the second component, Individual Characteristics, which highlights individuality and the source of differences in opinion, travel behavioral



trends models were analyzed to reveal the behavioral intentions of single occupant drivers to switch to higher occupancy transit options. Hartgen (1974) highlighted the role of two determinants in choice of travel: sociodemographic variables and attitudes. These were incorporated into the framework as they shape an individual's incomes and purchasing power, thereby affecting their ability to afford a car, pay for parking cost, etcetera. Golob and Dobson (1974) also contributed the impact people's perceptions and preferences had towards transit options had on their car culture. These are important as they would affect their willingness to utilize these transportation options, or otherwise, criticizes them. Lastly, inherent car culture was included as a guiding and supplemental sub-component to the others.

To connect car culture to a university environment, the component of Campus Environment was added, involving pre-set and fixed variables that are out of the car user's control. These indirectly but significantly shape an individual's desire to change their car culture as they predetermine certain circumstances. Sub-components under this are, the severity of parking problem, quality of transportation system and proposed incentives. The level of severity of the parking problem within a campus environment will affect an individual's car culture and willingness to drive in single occupancy and elevate this problem or carpool to mitigate it. The quality of alternative transportation system within and outside of the campus environment determines an individual disposition to rely on this as a full-time or part-time alternative to carpool or driving as a whole. Importantly, carpooling incentives, which are usually offered by the academic establishment, have shown to have a large impact on student thoughts and opinions towards carpooling.

These subcomponents were then grouped into five major themes: Satisfaction with

Parking, Quality of the Transportation System, Convenience, Comfort and Willingness, and Perceived Benefits and Drawbacks. These themes form the overarching structure of this research, and will be identified and analyzed individually, yet, in connection to one another.

## **Chapter 5: Research Questions and Hypothesis**

To efficiently change, or have an effect on the car culture of a student body, the target population must first be well understood, through an analysis of their opinions, concerns and standpoints in relation to car culture. With this understanding, it is feasible to construct both a wide and narrow view of how to cater to the needs and wants of the people, whilst balancing this out with a system that works for the university. It is known that the parking problem is a common major cry of student bodies. Therefore, by offering a possible means of solving or reducing the parking crunch, students should be more willing to voice their thoughts. For this research, other details and demographics such as travel time, income and willingness to share a car are also needed for the creation of an all-rounded and well-structured carpooling-based system that works for all, or at least the majority.

### **5.1 Research Questions**

A set of five hypotheses will be teste based on the following research questions. How convenience serve as an influencing factor on the car culture of commuting students at Binghamton University? Does the quality of the transportation system influence car culture and one's ability to change it? Does one's level of satisfaction with current parking conditions and incentives affect their car culture? How do comfort with carpooling and willingness to carpool affect carpooling potential at Binghamton University? How do the perceived benefits and drawbacks of carpooling affect one's inclination to carpool?

## 5.2 Hypotheses

Hypothesis 1: Convenience serves an influencing factor on car culture, and is a determinant of choice.

Hypothesis 2: The quality of the transportation system will independently and directly influence one's car culture

Hypothesis 3: The level of satisfaction with current parking conditions and incentives will affect car culture, and potentially serve as an instigator to change it.

Hypothesis 4: Student's comfort with carpooling and willingness to carpool will affect the overall carpooling potential at the university.

Hypothesis 5: The perceived benefits and drawbacks of carpooling will highlight the factors of importance and unimportance to students regarding carpooling.

Overall, the general hypothesis is that, through the analysis of the five factors (Satisfaction with Parking, Quality of the Transportation System, Convenience, Comfort and Willingness, and Perceived Benefits and Drawbacks) that have been hypothesized to influence the intentions of single-occupancy driving, as well as the identification of the viewpoints and attitudes towards or against carpooling, it will be possible to highlight potentially successful initiatives to instigate car culture change and reduce the parking problem at Binghamton University.

## **Chapter 6: Methodology**

### **6.1 Identification of Target Population**

To properly analyze the parking problem and construct a means for resolve through car culture change, the major contributor to the parking problem must be identified. The identification of a target student population and grouping process is illustrated in Figure 2. To begin, a list of all the names and email addresses of those who had purchased a Binghamton University parking pass for the year was obtained from the Transportation and Parking Services at Binghamton University. Then, faculty and staff were filtered out, leaving only students. This population pool was then filtered further based on parking permit type, as students who live on campus with resident parking permits were filtered out, leaving only commuter students with commuter parking permits. Also, incorporating time spent on the university campus and knowledge of it, graduate students were filtered out due to the fact that they, on average, spend less time at the university, and make a short-term impact to its car culture, when compared to undergraduate students.

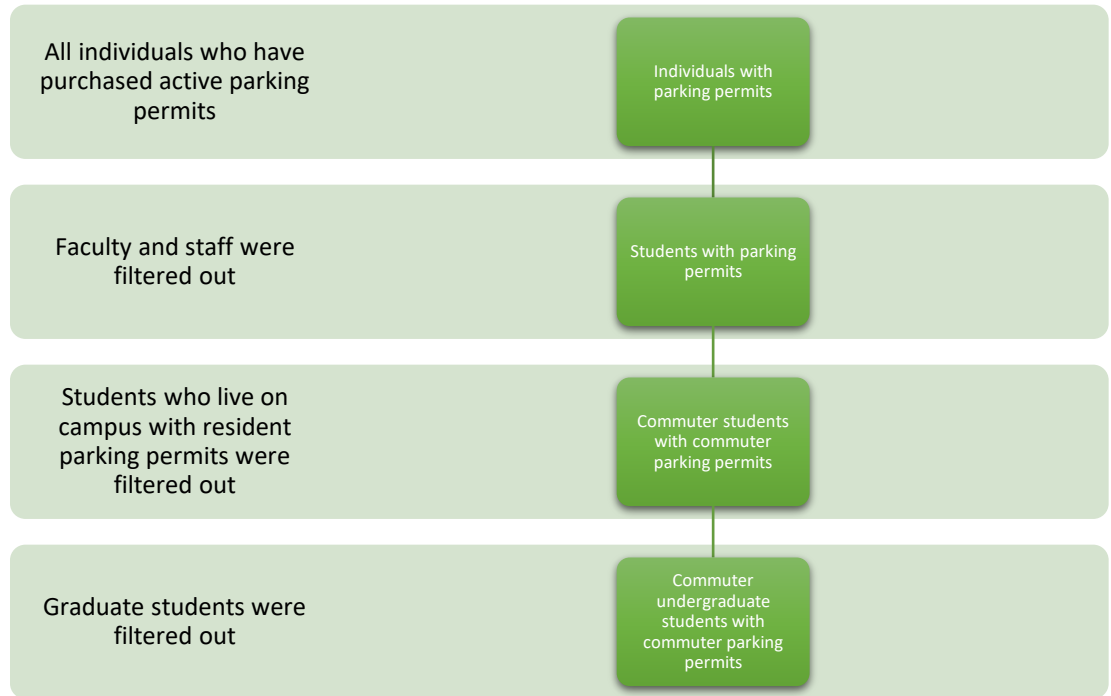


Figure 6.1: Identification and Grouping Process of Student Groups

The final result was a list of commuter undergraduate students with commuter parking permits, whom were identified as the target population for this research. This list served contained mainly students of sophomore-year standing or higher, since students in freshmen year can only obtain a commuter parking permit if they live in the area.

## 6.2 Data Collection

For this research, a web-based survey was conducted in late November of 2016. This survey was disseminated to the target population group created in the previous section, by the Transportation and Parking Services of Binghamton University. The survey did not ask for any private information of respondents, who were also kept anonymous. After staying active for 2 weeks, the survey obtained a total of 824 responses.

The survey was designed to address the themes created in the conceptualization., and questions were structured to obtain information in three different areas: personal demographics, individual campus commute and attitude on university parking and transportation systems, and potential to use carpooling as an alternative transportation options. Survey questions based on satisfaction, drive time, comfort level with carpooling, perceived benefits, and perceived drawbacks of carpooling. Different question formats such as multiple choice, rank order, and text entry were used in the survey. For analysis of the data, a mixed-analysis approach was taken.

Quantitative research was used for close-ended questions and was supplemented using R, a programming language for statistical computing, and SPSS, a software language for statistical analysis as well. These programs were used to run Chi-square tests and Linear multiple regression to construct models, as well as test for significant relationships between variables. On the other hand, qualitative research was used to analyze open-ended questions and was supplemented using NVivo, a software for qualitative data analysis. This program was used for the creation of nodes, classifications, and cases to effectively categorize the open-ended survey responses. It was also used to run word searches, word frequency queries, as well as more complex coding queries.

## Chapter 7: Preliminary Demographics

For some context, some preliminary demographics were outlined, highlighting the distribution of the population in terms of gender, income, and location.

### 7.1 Gender

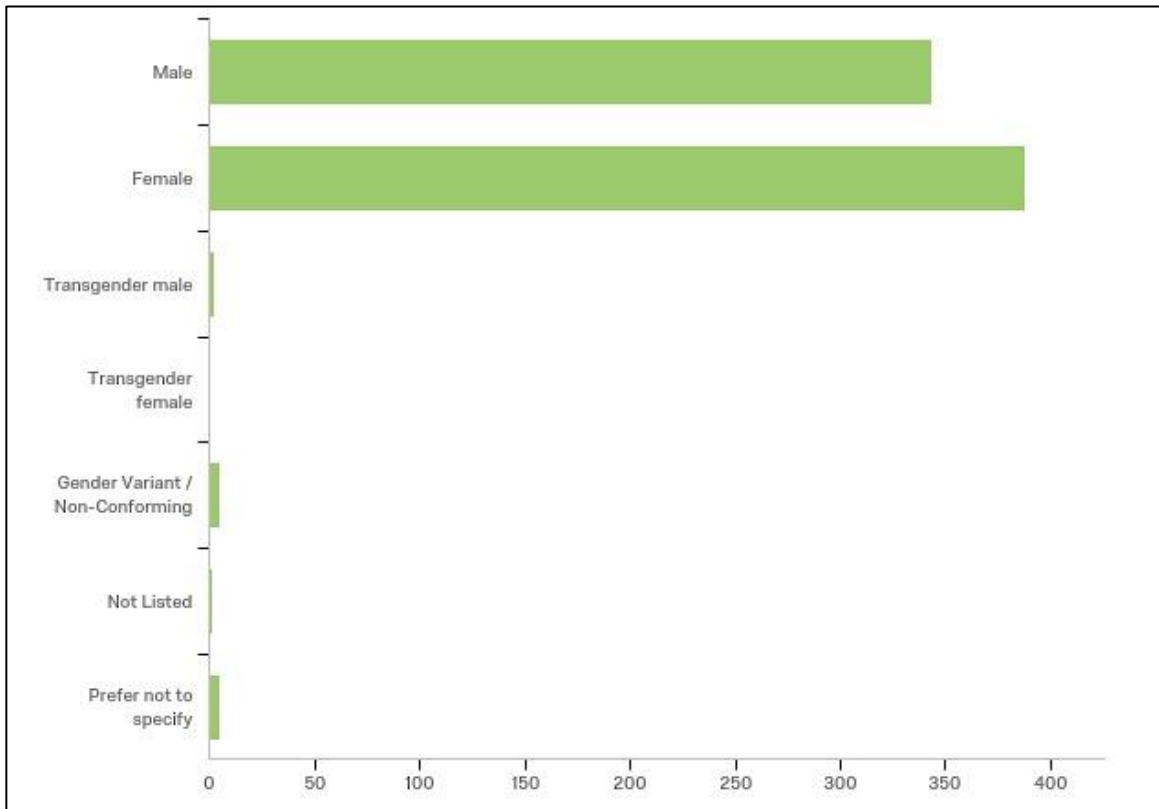


Figure 7.1: Gender Distribution of Population

The gender distribution of the population was as follows: 46% Male, 52% Female, 0.27% Transgender Male, 0% Transgender Female, 0.67% Gender-Variant or Non-Conforming, 0.13% Unlisted and 0.67% Preference not to Specify.



## 7.2 Income

The median income of the population was \$267, with the maximum at \$1000, and minimum income at \$0.

## 7.3 Location

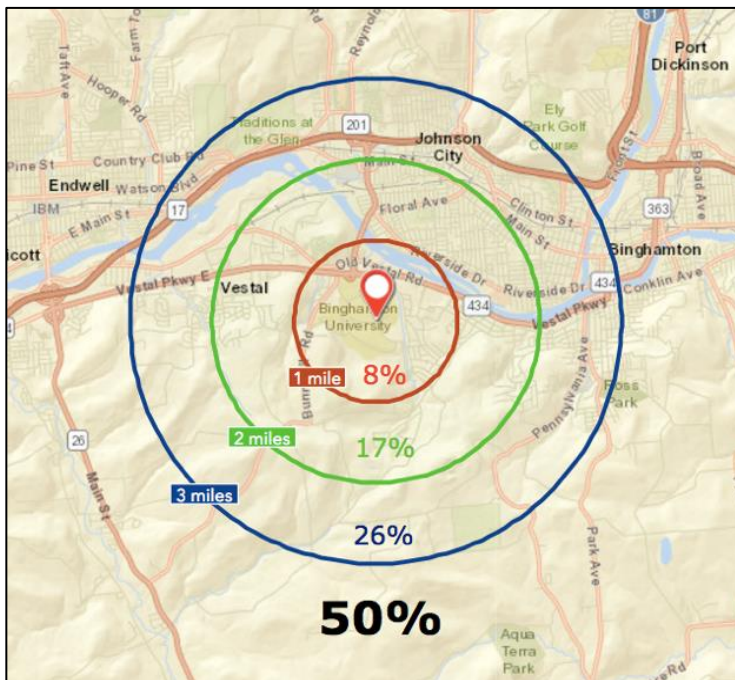


Figure 7.2: Location Distribution of Population

For the location distribution, about 8 percent of students live within 1 mile of Binghamton university campus, about 17 percent of students live within 1 and 2 miles of campus, about 26 percent of student live within 2 and 3 miles of campus, and about 50 percent of students live over 3 miles away from campus.

## Chapter 8: Results

### 8.1 Convenience

Convenience is a strong motivation for consumers, and is a large driver of choice. People like to do things, or in this case, commute to places, in the easiest and quickest way possible. For this reason, it is to no surprise that, as shown in Figure 8.1.1, the word ‘convenience’ is disproportionately blown up in the word cloud, and was the most popular term from the word frequency analysis of all qualitative survey responses.



Figure 8.1.1: Word cloud of high frequency words used in response to survey question ‘What is your main reason for driving to campus, over using public transportation?’

Although, the general idea of convenience as a driving factor in current car culture is not enough to change this culture nor understand it. Therefore, using NVivo, an in-depth qualitative analysis was done on the occurrence of the word ‘convenient’ in the survey responses. This allowed for a better understanding of why and in what ways convenience affects consumer choice of how they commute. For a broader analysis, stemmed words

such as 'convenient', 'convenience' and 'conveniently' were included, as well as misspellings such as 'convenience' and 'convinience' were included in the word frequency search.

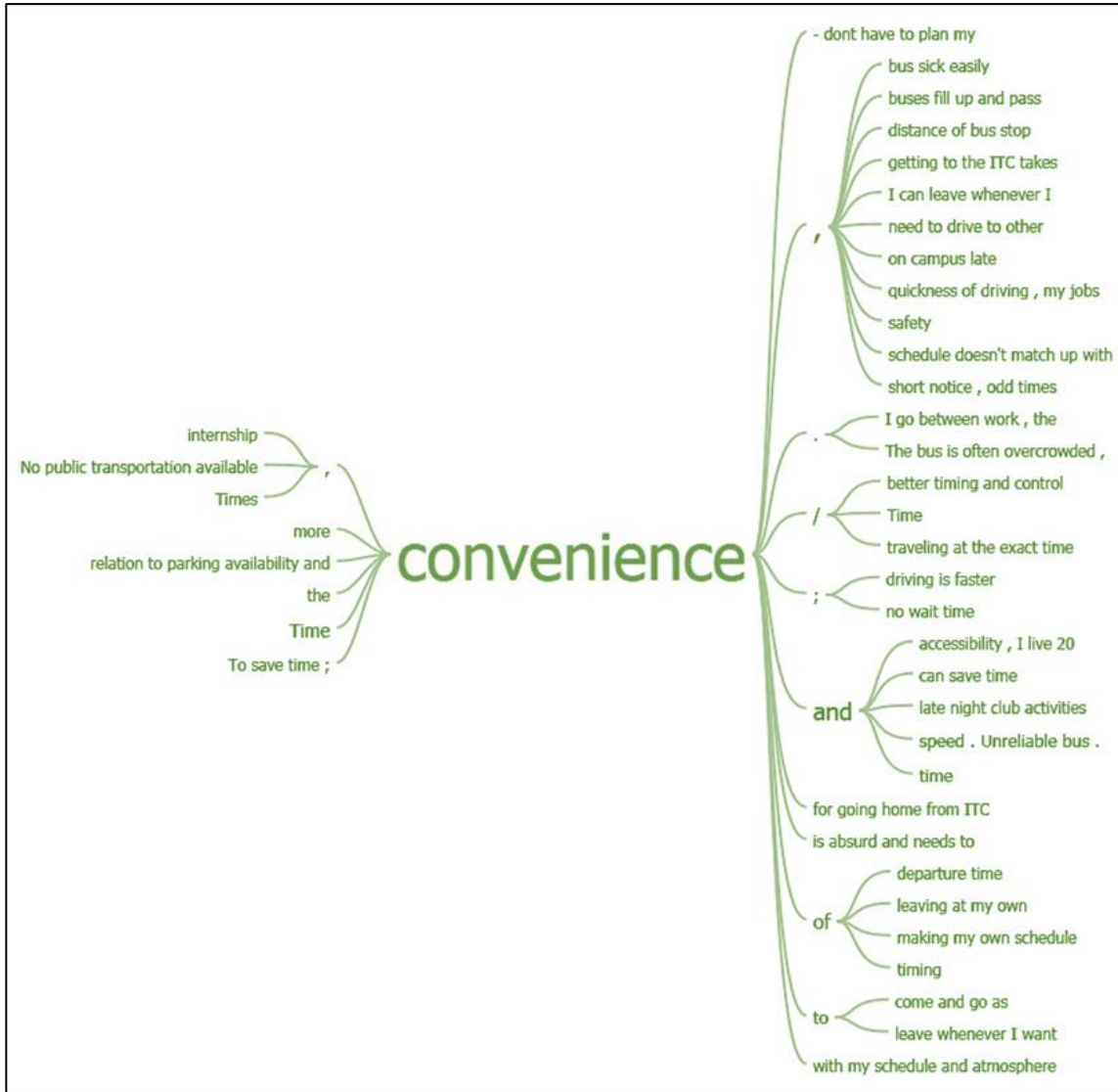


Figure 8.1.2: Word tree of word 'convenience'

As shown in the word tree above, generated by NVivo, convenience was mentioned in relation to time, safety, an unreliable bus system, and other general reasons of why driving is more convenient for them like the flexibility of departure time and scheduling. From this

chart, the desire for freedom, control of one's timing, and flexibility to come and go as one pleases is evident, things that respondents claim the current bus system does not provide.

Another important concept under the theme of Convenience is inconvenience. Viewing both ends of the sword here can provide perspective as to why students drive to school, but also, importantly, why they do not. A text search query of 'inconvenience' and its stemmed words pulls up ten references. Below are some excerpts from the findings, followed by the gender of the respondent, and well as the question this was in response to:

*"It seems obvious that there is not enough parking on campus, if I don't time it perfectly I can easily spend 15-20 minutes or more to find parking or even end up at Susquehanna and take the shuttle down which is very inconvenient."* (male, further comments)

*"The buses are gross, bumpy, take twice as long, and come at inconvenient times for when my classes start"* (female, reasons for driving to campus)

*"Please help the university fix their parking crisis. It is totally not okay to pay \$140 for a parking pass and have to drive around for 20-30 minutes in the middle of the day to find a parking spot in, usually, a very, very remote/inconvenient spot. By buying a parking pass, one should be guaranteed a parking spot on campus at all times. Thank you for your efforts in trying to better the problem we currently have"* (male, further comments)

*"As a college student carpooling with others is inconvenient because I am from the area and I do not live where the majority of off campus students are located. Also matching up busy college kids' schedules is very inconvenient but I can no longer come 30+ before my class starts to find a spot and still end up late."* (female, further comments)

The trend seen here is based on both the inconvenience of taking the buses, as well as the inconvenience of parking on campus. The former, the inconvenience of using the buses, is generally used to describe why students would rather drive to campus rather than faces the inconveniences attached with public transportation. The latter, the inconvenience of on-campus parking, is focused around the "parking crisis" that is present on the campus, as described by a respondent, which involves the difficulty involved with finding a parking spot on campus in a timely manner. Here, students understand the inconvenience of driving

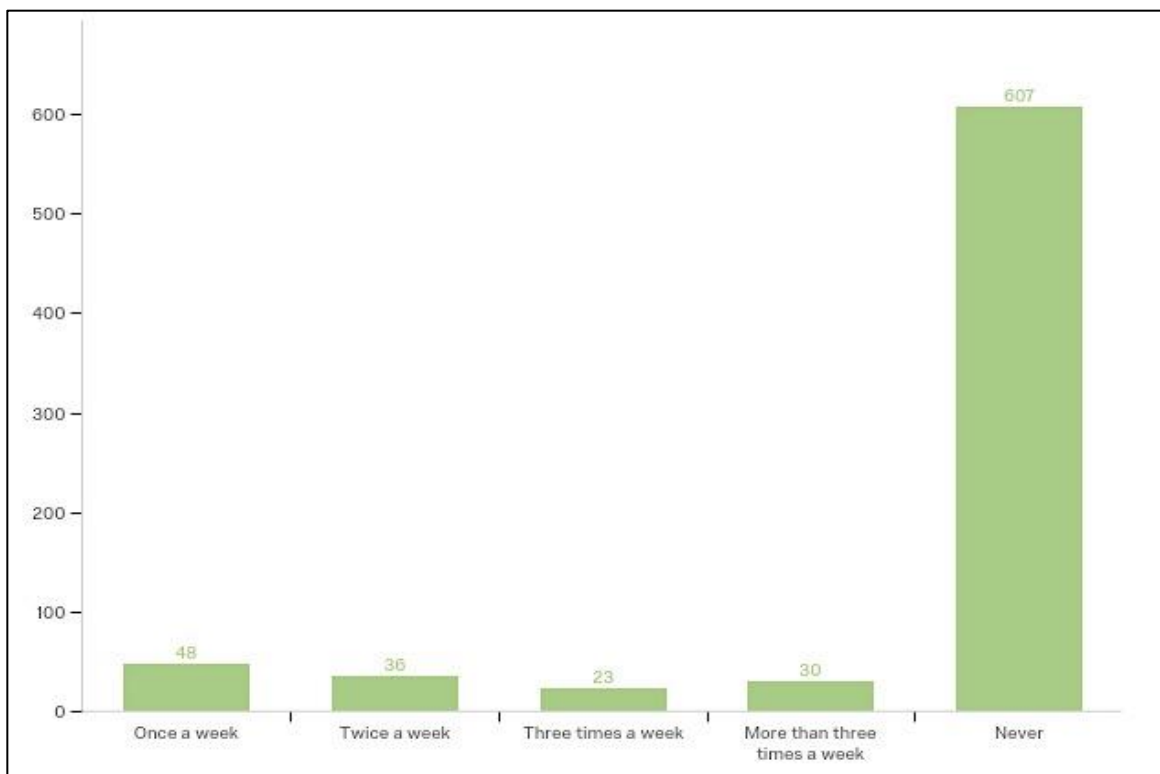
and having to park at an inconvenient spot, but choose to drive anyways. There is less of a desire to resolve this inconvenience by changing their car culture, but more so a demand for changes that will fit their car culture better. Overall for the theme of convenience, there is frequent mention of student comfort with carpooling, the on-campus parking crunch, as well as the quality of the transit system. As much as they contribute as factors to convenience, they are also themes in themselves and will be discussed in broader detail in following themes.

## **8.2 Quality of the Transit System**

The popular car-centric view of mobility of nowadays is largely as a result of the growth of generational car culture which has been on the rise since the 1900's, following the creation of the automobile. Although, car culture can also be reinforced when little to no alternate mobility options exist. Car culture can also be reinforced when these are limited or unreliable. In this case, the quality for a transit system can either work towards discouraging it through the provision of this alternative option, or can indirectly encourage it. In the sense that, when a transit system does not cater to the needs of a broad group of people, it deters potential users towards a reliance on cars. This theme is important in understanding the pre-set factors that independently exist outside car culture but either fuel or mitigate car dependency.

It can be inferred that when an area, or a campus in this context, is not carpool oriented, then it is either oriented towards single-occupancy driving or towards public transit. A major component involved in the promotion of a carpooling-based system is knowledge of the current transportation situation or trends of the target population. This

provides a base from which the carpooling system can be built upon and catered to, and serves as the stepping platform for future growth and development. Survey questions asked respondents how long their commute is from home to campus, how often they used the public transportation options provided by the university on a weekly basis, and to specifically state why they choose to drive to campus. These questions were asked to provide perspective on how much public transportation is ingrained in their day to day lifestyle, and identify the factors that potentially cause or contribute to this. The chart below highlights public transportation utilization on one's commute to and from campus, of respondents.



**Figure 8.2.1:** Public Transportation Utilization on Commute to/from Campus

At first glance, a strong skew in the distribution of the bar graph is evident. Over 80 percent of the commuter student respondents never use public transportation to school. It could be inferred that this is representative of students who drive to school every day,

with barely ever substituting for the other transportation services offered by the University. Without doubt, this proves that commuter students are mostly single-occupancy driving oriented, with only a few, less than 20 percent in total, who take public transportation between one to over three times a week. These results also emphasize the accuracy in the grouping and identification of student groups, as the target population was those who own a parking pass, and these results are evidence of that.

To understand whether this service limitation directly contributes to their car culture, an analysis of student distance from campus (based on commute distance), was done in relation to public transportation utilization frequency. As shown in Table 8.2.1, NVivo was used to create a cross-tabulation of both variables. The table serves to compare their relationship, with distance from campus as rows and public transit frequency as columns. The trend shows that generally, as the distance from campus reduces, so does the frequency of public transit use. Even when normalized with population density, as about 50% of students live over 3 miles away from campus, this trend is still significant. This is quite peculiar because one would expect that those who are further away would be less serviced by the buses and therefore, have less use frequency. On the other hand, it shows that even those who live far away are still willing to take the buses, and therefore need to be catered to and serviced by the buses. Using R, a Pearson's Chi-square test was also run on these two variables, with a Null Hypothesis that there is no relationship amongst the variables, and an alternate hypothesis that there is a relationship, yielding the following results:

	Never	Once a week	Twice a week	Three times a week	More than three times a week
<b>Above 3 miles</b>	334	20	18	7	13
<b>3 miles</b>	125	17	3	5	3
<b>2.5 miles</b>	45	8	3	1	2
<b>2 miles</b>	67	8	5	4	2
<b>1.5 miles</b>	26	1	6	0	3
<b>1 mile</b>	25	5	3	4	12
<b>0.5 mile</b>	10	2	2	0	1

*X-squared value = 70.956, p-value = 0.0004998*

Table 8.2.1: Results of Chi-square test and Cross-tabulation of student distance from campus (based on commute distance) and public transportation utilization frequency.

Using an alpha of 0.05, and with a p-value this small, this statistical test confirms that these variables are indeed dependent, and we can reject the null hypothesis. Furthermore, a focused qualitative analysis was done on solely the open-ended responses to why students choose to drive to campus, over using public transportation. From the analysis, the sub theme of Availability and Accessibility can be deduced. This is mostly centered on the buses, how available they are to the students, and the feasibility of getting on the bus. This trend is descriptive of students' discontent with the availability and accessibility of buses, and how this makes them fall back to using cars. Topics that arise in this theme, as shown in the world cloud are - seats, full, crowded, unreliable, ease, efficient, available and near. The backing trends here are unpredictability and uncertainty, as students highlight how buses are often overcrowded and therefore, unreliable. Students also state how buses are often full by the time they arrive at their bus stop, which makes students have to wait for the next bus and late for class. There is also mention of how the sometimes far distances of bus stops make the buses less accessible, and how certain bus stops have been removed, changed or are unsafe.



Riding experience could also be deduced as a subtheme with the identified word trends of – ‘smell’, ‘cold’, ‘feel’, and ‘comfort’. Students highlighted how buses are sometimes hot and stuffy because they are packed. Students also raised concerns about certain foul smells on buses sometimes, and how this has been a deterrent. Some generally feel more comfortable driving themselves and consider it to be a more pleasurable experience compared to the riding experience of the buses. The cold months also make the general riding experience less pleasurable as students don't want to wait in the cold. With Binghamton being the seventh cloudiest city in the United States, as well as one with a humid continental climate of harsh snowy winters, this is to no surprise. Figure 8.2.2 shows a pictorial representation of student responses along the word trend of “cold.”

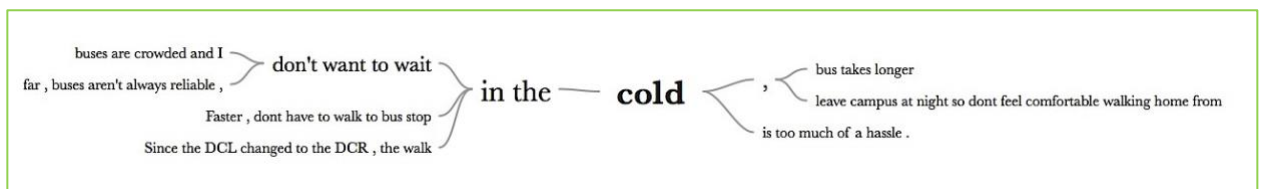


Figure 8.2.2: Word tree of word ‘cold’ from qualitative responses

### 8.3 Satisfaction with Parking

As with the implementation of any major change, an implementation of a car culture change involves an accurate understanding of the current situation at hand, before the creation of change. Only an understanding of the present can properly guide the future, and therefore this perspective is highly important. Gaining knowledge of the present parking conditions and situations creates a platform which highlights the present state and the need, or the lack of thereof, for change or persistence. It also provides an estimation of to what extent this needs to occur. To create the premise for this understanding, students were directly asked how satisfied they are with the current parking options on campus.

Figure 8.3.1 below highlights the distribution of student respondents based on their satisfaction level.

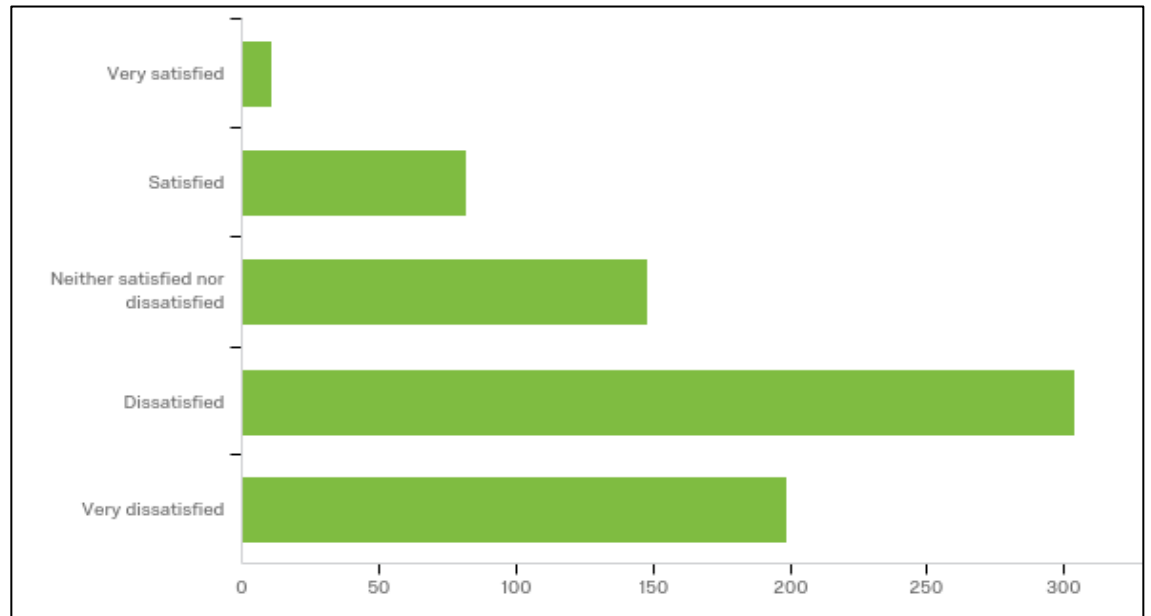


Figure 8.3.1: Student Satisfaction with Parking

About a fifth of the respondents, about 20 percent, are neutral with their satisfaction, and are neither satisfied nor dissatisfied. On the other hand, a majority of students, at 41 percent, responded to be “Dissatisfied” with parking, while another 27 percent responded to be “Very Dissatisfied” These percentages add up to form 68 percent, over half of the population, that is not satisfied which with the state of parking. This leaves only 12 percent of students who responded to be satisfied with parking, with only 2 percent that are “Very Satisfied.” These results are explanatory of the current state of parking on the Binghamton University campus and the conclusion that the satisfaction level is quite low, can be drawn. Using R, further conclusions and relationships were tested.

### **8.3.1 Satisfaction with Parking and Public Transit Use**

Firstly, to connect the theme of satisfaction to previous themes analyses, a statistical analysis between satisfaction with parking and public transit use was run using Pearson’s Chi-Square Test, with the null hypothesis that there is of no relationship, and an alternate

hypothesis that there is a relationship. The results were as follows:

	<b>Never</b>	<b>Once a week</b>	<b>Twice a week</b>	<b>Three times a week</b>	<b>More than three times a week</b>
<b>Very Satisfied</b>	3	1	2	0	0
<b>Satisfied</b>	52	5	8	3	3
<b>Neither Satisfied nor Dissatisfied</b>	99	7	10	6	4
<b>Dissatisfied</b>	219	13	14	5	10
<b>Very Dissatisfied</b>	139	18	2	4	9

*X-Squared = 31.049, p-value = 0.02849*

Table 8.3.1: Results of Chi-square test and Cross-tabulation of satisfaction with parking and public transportation use

Based on this, and with an alpha of 0.05, the test is statistically significant as the p-value (0.02849) is less than 0.05 and there is a relationship between students’ level of satisfaction with parking and their public transit use. As shown in Table 8.3.1, this relationship has a general positive pattern in the sense that, as the public transit frequency falls, so does the satisfaction with parking on campus. This highlights the fact that although a majority of people are quite unsatisfied with on-campus parking, they *still* never use the buses, simply emphasizing the strength of car culture.

### **8.3.2 Satisfaction with Parking and Importance of Proposed Incentives**

Binghamton University offers parking incentive, as a means to open up for parking spaces and curb the parking crunch. Although, overall, these have not been very successful

at the university. For this reason, new incentives were proposed to survey respondents in order to gauge how important these proposed incentives would be to them.

Respondents were asked how important incentives like financial incentives, a free garage or paid lot pass and custom ride mate pairing. The and findings are presented below.

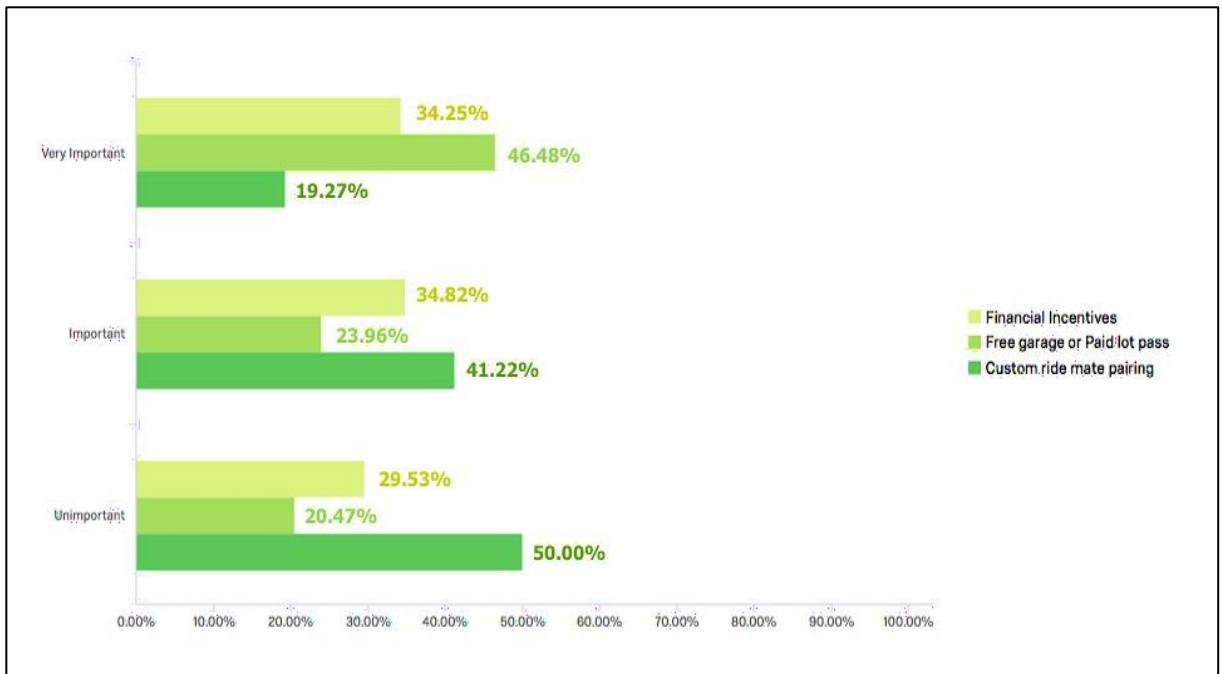


Figure 8.3.2: Level of Importance of Certain Incentives

Figure 8.3.2 above describes the importance level attributes to each of the proposed incentives. From the table, it can be deduced that most respondents believe a Free garage pass o paid lot pass is the most important amongst incentives, while a Custom ride mate pairing has the most ‘Unimportant’ votes. Proposed incentives and the importance of this response data will be reviewed more in depth further down in this research paper. This section aims to test for a possible relationship between satisfaction with the current parking options and the student attitude towards these incentives. A Pearson’s Correlation test was run on each of the incentive categories, crossing this with the same categorical data on satisfaction with parking used previously in this theme. The results are as presented below:

Satisfaction x Financial Incentive

**X-squared = 5.9849, p-value = 0.6842**

Satisfaction x Free garage or Paid lot pass

**X-squared = 15.117, p-value = 0.06397**

Satisfaction x Custom ride mate pairing

**X-squared = 5.2924, p-value = 0.7216**

Using an alpha of 0.05, all the p-values from the tested relationships correlations are too low to be statistically significant. From this, we can conclude that there is no relationship between the attitudes of student's respondents towards the proposed incentives and the satisfaction with current parking options offered.

### **8.3.3 Satisfaction with Parking and Parking Time Duration**

As described in previous themes, the concept of time was prominent in word search queries of survey data. An important aspect of this concept was the prolonged timing it took students to find a parking spot on campus. In the survey, respondents were asked to specifically state how long it took them, in minutes, to find a parking spot on campus. The summary statistics as well as a histogram of the parking duration data are presented below<sup>1</sup>:

**Minimum Value:** 0 minutes

**Maximum Value:** 20 minutes

**Mean Value:** 9.5 minutes

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<sup>1</sup> Note: Out of 636 responses, only 571 respondents provide information of their parking time duration, leaving out 65 values. Also, respondents were informed that the aim of this research is to help changing the car culture at Binghamton University and potentially help reduce the parking problem. Therefore, it can be assumed that some over estimation or inflation of parking time duration is a possibility.

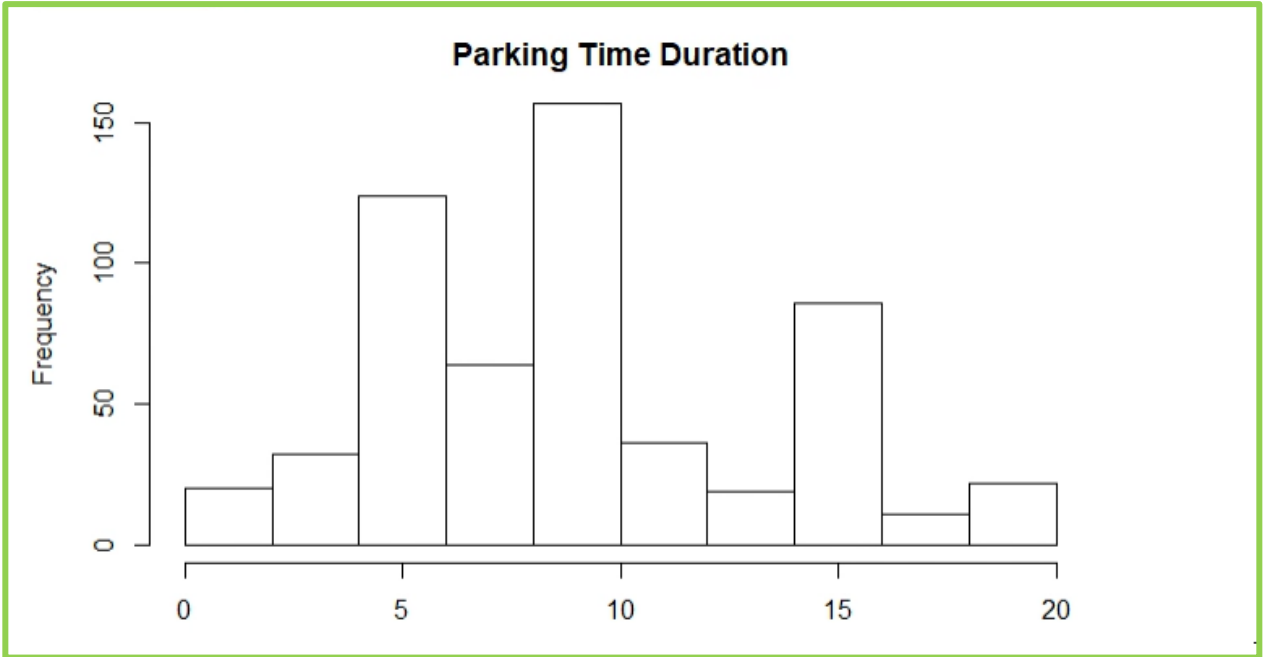


Figure 8.3.3: Parking time duration does not have a normal curve, as there are many students who normally need about 5, 10 or 15 minutes to park, but few in between.

		Satisfaction with Parking					
		Very Satisfied	Satisfied	Neither Satisfied nor Dissatisfied	Dissatisfied	Very Dissatisfied	TOTAL
Parking Time Duration	0	3	0	0	1	0	4
	1	1	3	3	0	0	7
	2	0	3	3	3	0	9
	3	0	6	9	3	0	18
	4	0	4	7	3	0	14
	5	2	25	31	40	11	109
	6	0	2	4	9	0	15
	7	0	5	10	17	3	35
	8	0	1	13	10	5	29
	9	0	0	0	2	2	4
	10	0	14	24	75	40	153
	11	0	1	0	7	2	10
	12	0	2	2	17	5	26
	13	0	1	2	9	2	14
	14	0	0	1	1	3	5
	15	0	3	9	37	31	80
	16	0	0	1	3	2	6
	17	0	0	1	4	1	6
	18	0	0	0	0	5	5
	20	0	0	2	2	18	22
<b>TOTAL</b>		6	70	122	243	130	571

Table 3.3.3: Cross tabulation of Satisfaction with Parking and Parking Time Duration

Table 3.3.4 provides a cross-tabulation of both variables, where for example, 25 people are satisfied with parking and spend five minutes looking for a spot. Focusing on the last row and last column of the table, which present the total numbers of minutes spent parking for each minute category versus the total numbers of respondents in each level of satisfaction category, there is no clear trend between variables. Satisfaction values rise as the level of satisfaction falls, but parking time duration is more randomized and clustered

around the 5, 10 and 15 minute increments. Though, not seen as strongly here, parking time duration does have some correlation with satisfaction with parking, as previous themes through qualitative analysis.

#### **8.4 Comfort with Carpooling**

As mentioned in the previous theme, an accurate understanding of the situation at hand is necessary to properly plan and execute for the future. Comfort with carpooling, and willingness to carpool are very important and underlying factors in measuring the potential effectiveness of a carpooling system on a college campus. This is because, if students are unwilling to carpool and uncomfortable with this alternative transport option, such a system is likely to fail. On the other hand, if students are willing and comfortable to carpool, the system is more likely to succeed.

This section measures the disposition of students to share a ride with others on their commute to/from campus. To measure the potential to change the car culture towards a more carpooling based system, two different approaches were made to analyze the comfort and willingness of students. The first approach was based on their current car culture and owner behavior through a measure of current ridesharing frequency per week. The second approach was based on the future potential car culture through measures like the level of comfort with sharing a ride, number of times willing to carpool in a week, and the relevancy of certain ride mate characteristics.



### 8.4.1 Current Carpooling Activity

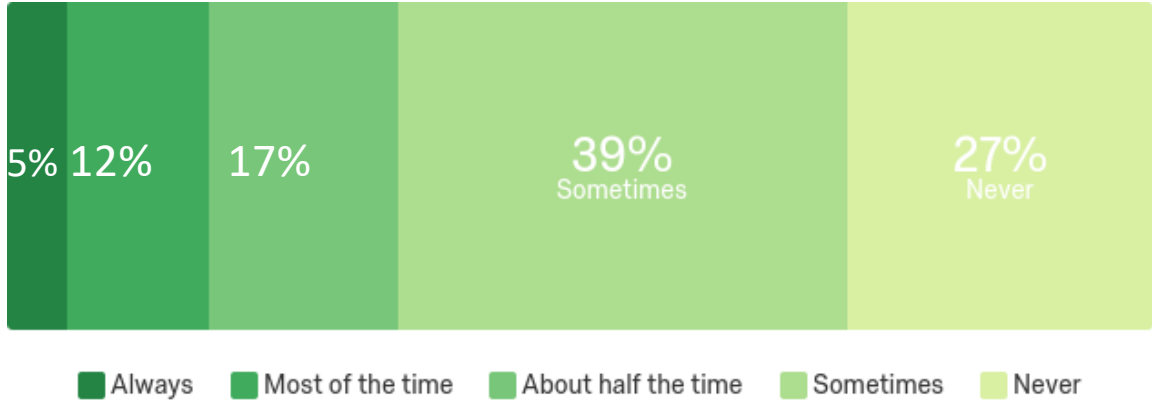


Figure 8.4.1: Student ridesharing frequency

Starting with the first approach, the bar graph of Figure 8.4.1 measures how often students already share a ride with others on their way to/from campus. The x-axis represents percentages measured while the y-axis separates the category choices provided. The clear outlier in this distribution is the “Sometimes” variable. That is, the majority of students (about 40 percent) rarely and only “Sometimes” ride with others. This is followed by the value of about 200 students who “Never” share a ride with others.

### 8.4.2 Potential for Future Carpooling Activity

The second approach was based on a future change in car culture towards a more carpooling based system. Survey respondents were asked to scale their level of comfort with carpooling from “Very Comfortable” to “Very Uncomfortable,” as well as answer how many time in a week they would be willing to share a ride with others. This information was asked to serve as a platform to forecast the potential carpooling system customer pool, and the results are presented below:

### 8.4.2.1 Willingness

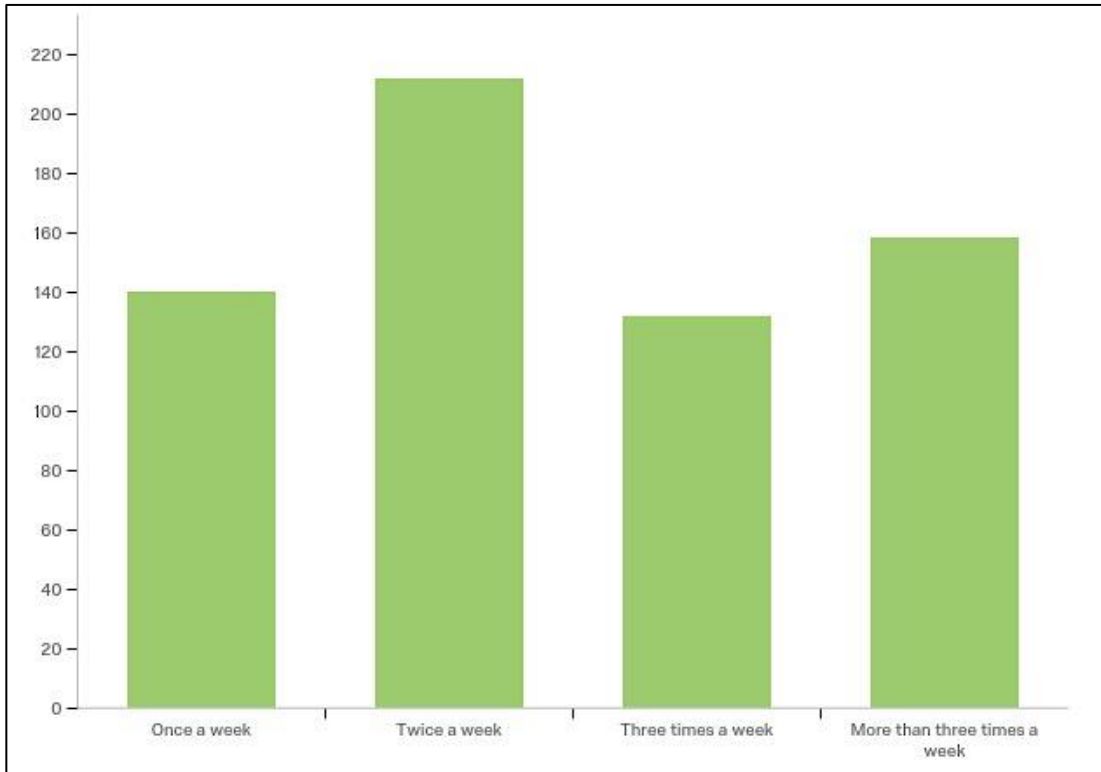


Figure 8.4.2: Number of times willing to carpool in a week

As shown in Figure 8.4.2, all respondents were willing to carpool at least once a week. These results showed positive willingness with over 30 percent of students willing to carpool twice a week, about 20 percent for three times a week and about 25 percent for over three times a week. Contrary to the present situation described in the first approach in which students do not share rides often, as shown by these results, students would be willing to do this if such a system was created. Both approaches combined to highlight the potential for creating a substantial change in the car culture while conveying a level of reliability in the student customer pool, and are appropriate to answer the question of if students would be willing to carpool.

### 8.4.2.2 Comfort

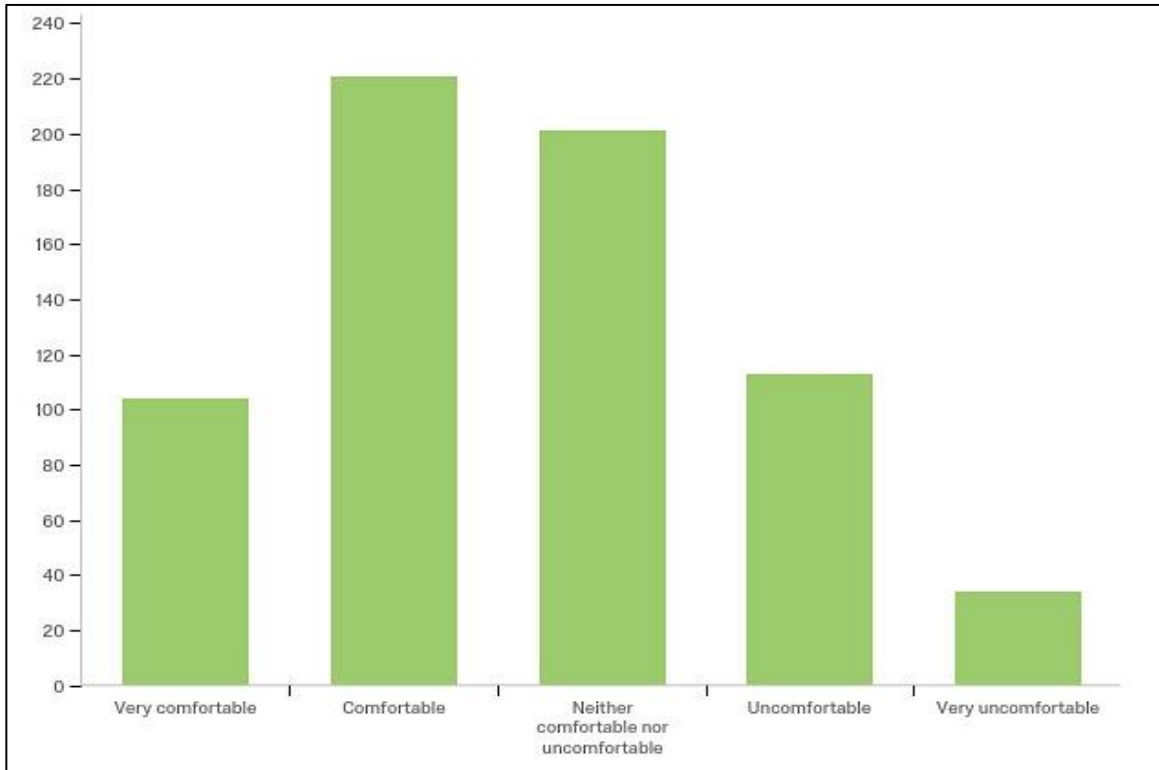


Figure 8.4.3: Level of Comfort with Sharing a Ride

Over 30 percent of students, the majority of respondents expressed to be “Comfortable” with the carpooling, followed by students who were “Neither comfortable nor uncomfortable,” a little less than 30 percent of respondents. Also, only a small population of about 5 percent responded to be “Very Uncomfortable.” Integrated, these emanate the idea that the level of comfort for students with sharing a ride is average. To analyze this from a qualitative point of view, NVivo was used to run a word search on the word ‘comfort’ and its stemmed words. The findings provided 12 references, some of which are listed below:

*“I feel like it’s faster to get home in my car and I’m more convenient driving myself than using public transportation, which I have never used before” (Male, reasons for driving to campus)*

*“Faster, don’t have to walk to campus in the cold. I leave campus at night so I don’t feel comfortable walking home from the bus stop in the dark” (Female, reasons for driving to campus)*

*“I’m not comfortable with trying to figure out the transportation system Also, if I have a car, I might as well use it” (Male, reasons for driving to campus)*

From these excerpts, we see that responses related to comfort are mostly based on the comfort of using a car, and the discomfort associated with the public transit systems, both with fall into expected car culture attitudes and ideals.

To test for some correlation between willingness and comfort, a Pearson’s test was run using R, with the null hypothesis being the absence of a relationship and the alternate hypothesis being the presence of one. As previously stated, if a student is comfortable with carpooling, they are more likely willing to do it, as with any else. Therefore, as expected, the results from this test as described below, coupled with a cross table:

	<b>More than three times a week</b>	<b>Three times a week</b>	<b>Twice a week</b>	<b>Once a week</b>
<b>Very Comfortable</b>	55	22	20	5
<b>Comfortable</b>	62	54	76	22
<b>Neither comfortable nor uncomfortable</b>	29	40	70	55
<b>Uncomfortable</b>	9	13	37	45
<b>Very uncomfortable</b>	3	1	6	12

X-squared: 134.14, p-square =0.0004998

Table 8.4.1: Results of Chi-square test and Cross-tabulation of satisfaction with parking and public transportation use

Using an alpha of 0.05, the test is statistically significant because the p-value (0.0004) is less than 0.05. This means that there is a relationship between comfort with

carpooling and willingness to carpool, one which is further emphasized by the cross table of Table 8.4.1. Here, cluster patterns of respondents are evident with those who are more comfortable with carpooling and more willing to carpool, as well as those who are less comfortable with carpooling and less willing to carpool. This information is important because it permits us to assume that, if you can make someone more comfortable with carpooling, you simultaneously can make them more willing to do so. These are the kind of ideas that urban or transportation planners can work with to discover solutions, and will be discussed further in this research.

#### **8.4.2.3 Ride mate Characteristics**

Different variables, such as specific characteristics of ride mates, could be responsible for a student's' comfort, discomfort or neutrality with sharing a ride. This was analyzed in the survey as respondents were asked to choose from a list of certain characteristics of ride mates (gender, race, nationality/originality, smoker/non-smoker, none), which would be relevant to them when choosing an ideal ride mate.

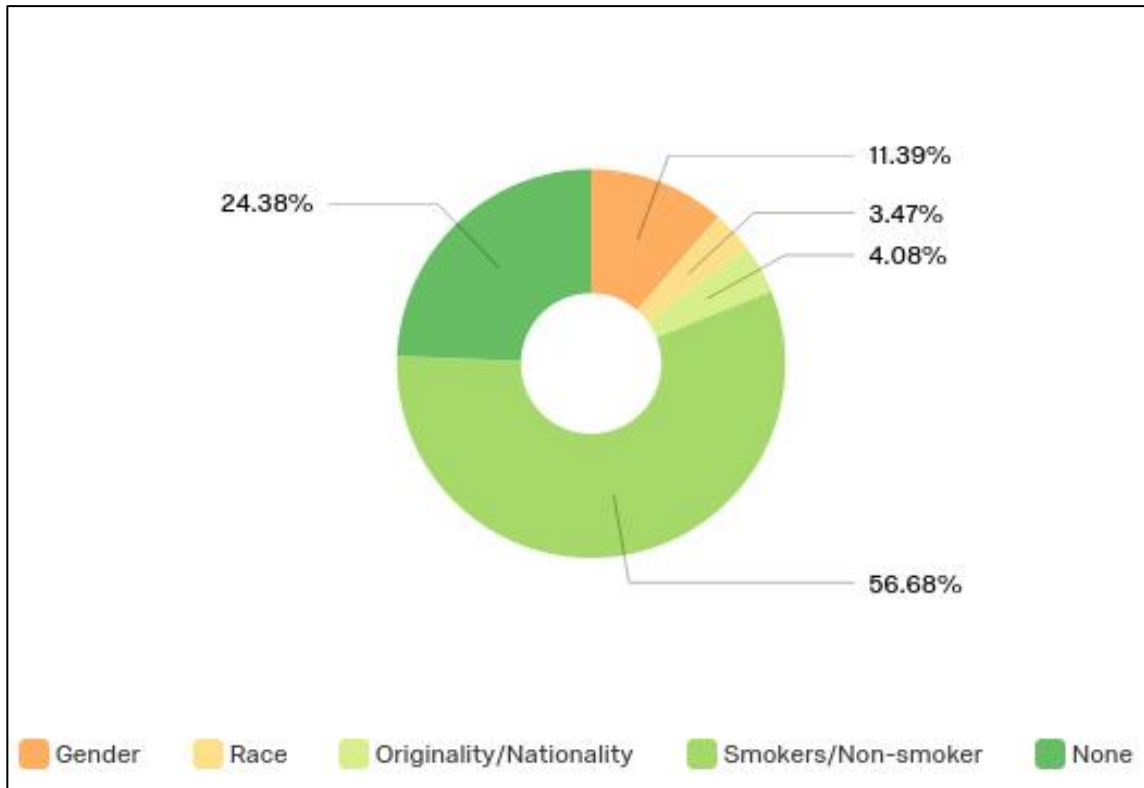


Figure 8.4.4: Relevancy of Certain Ride Mate Characteristics

According to the figure above, the most relevant characteristic to the students was whether their ride mate is a smoker or non-smoker. It can be inferred, from popular opinion, that the smell of smoke created from this act could create some form of discomfort for ride mates. The next most relevant characteristics, is the lack of thereof - as about 25 percent of students do not care about certain characteristics of ride mates and responded with “None.” In addition to these, other characteristics like gender, race, and originality remained low.

To test the relevancy of these ride mate characteristics, SPSS Statistics was used to run a linear regression analysis where comfort with carpooling was set as the dependent variable while all five characteristics were set as the independent variables. The results from the regression analysis are presented in Table below.

Model	Coefficients <sup>a</sup>				
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.954	.223		13.265	.000
Smoker	-.435	.221	-.192	-1.966	.050
Gender	.327	.129	.109	2.537	.011
Origin	.065	.229	.014	.284	.776
Race	.388	.250	.075	1.550	.122
None	-.516	.233	-.221	-2.211	.027

a. Dependent Variable: Comfort  
**Table 8.4.2:** Linear Regression Model with Ride Mate Characteristics as independent variables and Comfort as the dependent variable

Using an alpha of 0.05, the p-values of ‘Smoker or Non-Smoker (0.05), Gender (0.011) and None (0.027) were all less than or equal to 0.05, and therefore are statistically significant. Other characteristics, Origin and Race, had p-values less than 0.05 and are independent. To possibly provide a broader perspective, further regression analysis was run to test for significance of both gender and income of participants, in relation to whether they chose any of the significant variables – Smoker or non-smoker, gender, and None.

## Gender

		<b>Coefficients<sup>a</sup></b>				
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	1.438	.128		11.194	.000
	Smoker	.095	.128	.072	.741	.459
	Gender	.302	.072	.173	4.196	.001
	None	.095	.135	.070	.705	.481

a. Dependent Variable: Gender

Table 8.4.3: Linear Regression Model with (significant) Ride Mate Characteristics as independent variables and Gender as the dependent variable

Results show that the gender of the respondent significantly affects whether they pick gender as an important ride mate characteristic, and is a variable that is dependent on itself.

## Income

		<b>Coefficients<sup>a</sup></b>				
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
	(Constant)	206.173	65.383		3.153	.002
	Smoker	72.926	64.962	.134	1.123	.262
	Gender	38.844	35.959	.053	1.080	.281
	None	36.112	68.465	.064	.527	.598

a. Dependent Variable: Income

Table 8.4.4: Linear Regression Model with (significant) Ride Mate Characteristics as independent variables and Income as the dependent variable

Results show that a respondent level of income did not significantly determine what kind of ride mate characteristics are important to them.



## 8.5 Perceived Benefits and Drawbacks

To potentially create a system that works for its consumers, one must be aware of what the target consumer population care about, or in this context, what students care about in relation to carpooling. This involves what students feel are strong suits of carpooling – what would make them join a carpool, and also what students feel are drawbacks- what would make them not want to join a carpool. It is important to know these about the target population to incorporate this information create the most efficient carpooling system that would cater to the population. In the survey, students were provided a list options of both common benefits and common drawbacks or carpooling, and were asked to select all that apply. This was done to create a perspective of particular attractions and deterrents.

### 8.5.1 Benefits of Carpooling

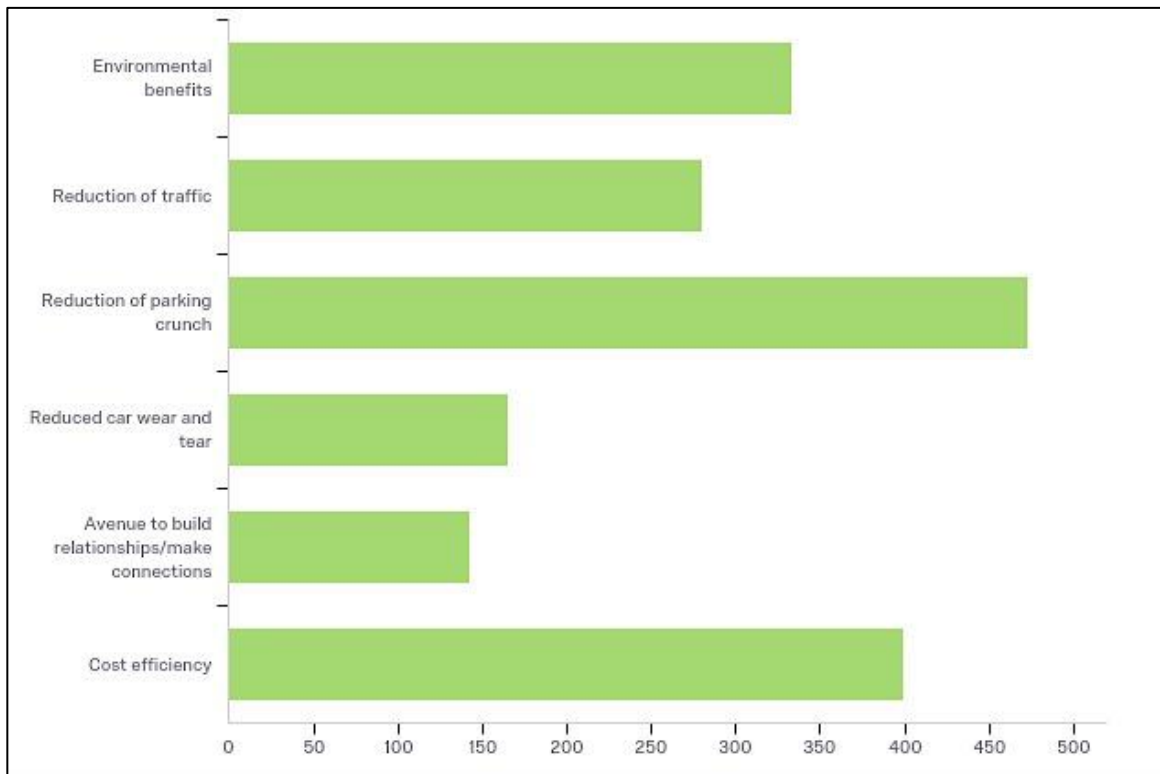


Figure 8.5.1: Benefits of Carpooling to Students

As shown in Figure 8.5.1 above, reducing the parking is something of high interest and need to the student body, as over seventy percent of respondents believed that this is a benefit to carpooling. Also, cost efficiency and environmental benefits seem to be important to students, as these have high percentages, which are interesting and unpredictable finds. As for other categories such as reduced car wear and tear, an avenue to build a relationship or make a connection, the response rate was relatively low in relation to others, but still exceeded a quarter of the respondents.

A linear regression was run to test the relationship between these benefits and the level of willingness to carpool, with willingness as the dependent variable and the benefits of carpooling as the independent variables. Below are the results:

Model	Coefficients <sup>a</sup>				
	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
	B		Beta		
(Constant)	1.874	.096		19.502	.000
Environmental Benefits	.307	.093	.141	3.314	.001
Cost Efficiency	.328	.090	.148	3.661	.000
Reduction of Parking	.198	.099	.082	2.004	.045
Reduction of Traffic	.128	.099	.058	1.297	.195
Reduction of Wear and Tear	.015	.104	.006	.149	.882
Avenue to Build Relationship	.262	.104	.099	2.510	.012

a. Dependent Variable: Willingness to Carpool  
**Table 8.5.1:** Linear Regression Model with Benefits of Carpooling as the independent variables and Willingness to Carpool as the dependent variable

Using an alpha of 0.05, the significant benefits of carpooling, as selected by survey respondents' variables were 'Environmental Benefits', 'Cost Efficiency', 'Reduction of Parking' and as an 'Avenue to Build Relationships', as these all had p-values below the alpha. On the other hand, reduction of traffic and reduction of wear and tear on cars were not statistically significant.

### 8.5.2 Drawbacks of Carpooling

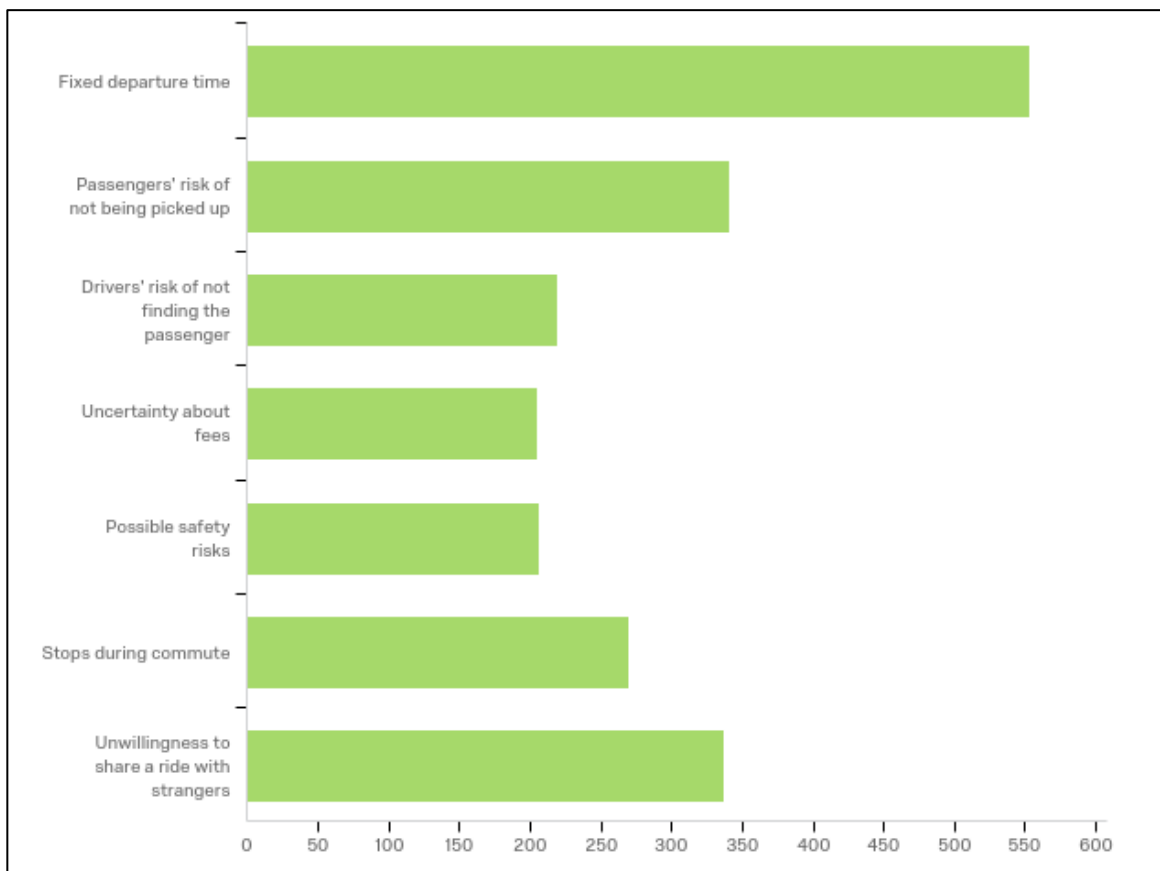


Figure 8.5.2: Drawbacks of Carpooling to Students

From hind's view of Figure 8.5.2 above, depicting the drawbacks of carpooling, it is easy to see the outlier in the data set as "Fixed departure time." Fixed departure allows for no flexibility in a person's routine, which could be unrealistic for a college student with

a dynamic life. The other options with the next highest percentages were – Passengers risk of not being picked up, stops during a commute, unwillingness to ride with strangers. These are all usual and expected carpooling drawbacks seen around the country. As with the rest of the options, it is up to the carpoolers to set guidelines and organize amongst themselves how they will run their own program.

A linear regression was run to test the relationship with these drawbacks and the level of willingness to carpool, with willingness as the dependent variable and the drawbacks of carpooling as the independent variables. Below are the results:

Model	Coefficients <sup>a</sup>				
	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	2.836	.111		25.482	.000
Passenger	.002	.097	.001	.022	.982
Fee	.268	.101	.112	2.650	.008
Driver	-.031	.105	-.013	-.292	.770
Safety	-.289	.102	-.121	-2.826	.005
Unwilling	-.343	.088	-.158	-3.915	.000
Stops	-.018	.096	-.008	-.191	.849
Departure	-.203	.111	-.073	-1.826	.068

a. Dependent Variable: Willing

Table 8.5.2: Linear Regression Model with Drawbacks of Carpooling as the independent variables and Willingness to Carpool as the dependent variable

Testing for the significance of the drawbacks of carpooling against willingness to carpool using an alpha of 0.05, the variables of ‘Uncertainty of Fees’, ‘Possible Safety Risks’, ‘Unwillingness to Share a Ride with Strangers’ and ‘Fixed Departure Time’. Interestingly, neither the ‘Drivers Risk of Not Finding the Passenger’, nor the ‘Passengers Risk of Not Being Picked Up’ were significant, showing that these are not top concerns for students, as might be assumed.

## **Chapter 9: Limitations in Analysis**

### **Gaps in Income Data**

About a third of survey respondents chose not to disclose income data. For this reason, the use of income data for socio-economic correlations was limited, and was mostly intentionally left out to avoid skews in data, overestimation or underestimation.

### **Distance Based on Miles Driven during Commute**

The data used to measure student distance from campus is based on distance driven to campus, that is, how long it takes a student to drive to campus, and not precisely their exact distance from campus. Although both of these variables are closely related, some differences may exist between them, based on route taken.

### **Lack of Specific Location Data**

The limitation faced here was the underestimation of student distances from campus, the option provided to students to answer the question on how far they lived from campus were limited, and thereby produced limited results with over 50 percent of students who live over 3 miles from campus. A more efficient question structure would have included higher increments such as 3.5 miles, 4miles, and so on.

## Chapter 10: Recommendations

In early 2015, Binghamton University created a carpooling incentive through Enactus, which is a national organization that facilitates college campus projects through sustainable solutions, a means to curb the issue of a lack of parking spaces. As described in Figure 11.1, the process was as follows: students signed up for the program, were added to a list used at the entrance of campus, were checked for on the list upon arrival using their ID, and handed a day voucher for a specific lot.

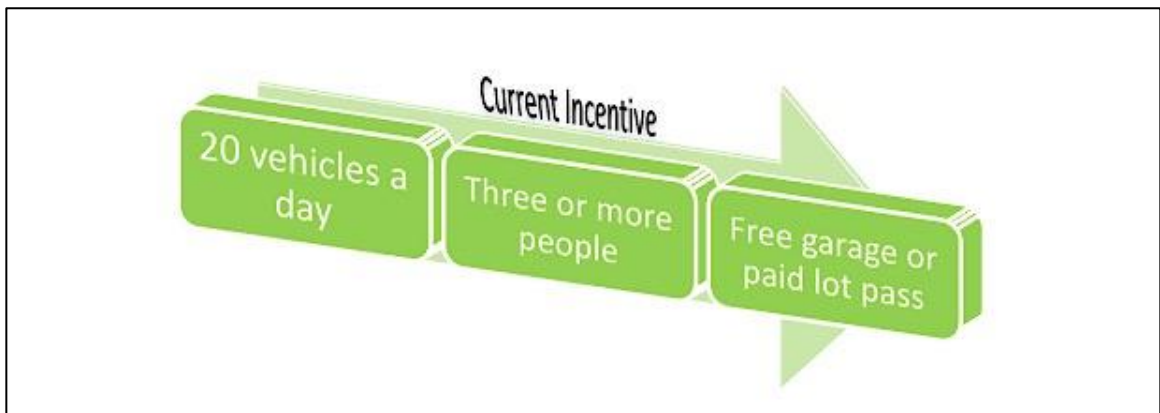


Figure 10.1: Current Carpooling Incentive

This incentive gained attention and picked up momentum at first, but after a while, participation began to die down, and in the long run the program was deemed unsuccessful. In October 2016, the university began to offer another incentive which was slightly different with hopes that it would be more successful. This incentive is as follows: Twenty vehicles per day that are traveling with three or more occupants will receive a free garage or paid lot pass by stopping at the Information Booth. For this incentive, the vehicle must

have a valid parking permit and all individuals in the vehicle must show their University ID. For this research, students were asked how on their awareness of this incentive, and many also left comments on their opinions regarding it. Below are some excerpts from student responses on incentives.

*“That promotion is underwhelming at best  
Monetary incentives will increase carpooling.”*

*“20 cars/day = uselessly small”*

*“I already bought a parking pass, so "free" parking is irrelevant to me. The parking incentive is not particularly incentivizing because it still requires regular commuters to purchase a parking pass. Just parking my car a little closer to class does not really matter to me. What matters most is how fast I can find a spot and how much money the pass is.”*

*“I was personally involved in creating the Enactus Carpooling Initiative during the 2014-2015 school year (which is the same exact program you are now offering). We utilized main perk of being able to park in the Paid Lot for free for the day and found limited success. The main issue we ran into was participants having three or more students in their car. While we tried to bring the number down to two, John Doe<sup>2</sup> would not allow it. I believe that no matter how many perks/incentives you offer ultimately this program will not be successful unless the limit is lowered to two occupants of each car. It is very difficult to gather a group of 3 students together on a consistent basis.”*

*“If I'm carpooling for BUs advantage than I would hope to earn the free parking pass regardless of whether or not I am within the first 20. Limiting this to the booth will bottleneck traffic while everyone tries to get to the booth for their pass, only to find they aren't eligible. Also, how would you know that the occupants of the carpooling car actually have their own cars back at home and that the carpool is actually saving spots? There are plenty of people living off campus using public transportation. I don't think that a carpooling incentive is a bad idea; parking on campus has become a terrible inconvenience. However, I think this process needs tweaking. Thank you for considering our comments!*

*“A lot of the time carpooling is not an option because a person doesn't know people with the same schedule as them (depart/arrive times). Also some people don't like the restriction of movement + spontaneity carpooling imposes. If there was an app that had drivers say (even just 10 min before leaving) what time they're leaving, from where + going where, and then ppl could sign up for that car + meet on campus, etc, then that might make sense.”*

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<sup>2</sup> Name changed to protect the privacy of the individual mentioned

Based on student responses, this incentive did not serve the student body as it should have, and was neither incentivizing nor inclusive. Therefore, the following recommendations were made towards creating a more successful and cohesive environment that promotes car culture change:

### **10.1 Promotion of Better Incentives**

One main recommendation would be the promotion of better services that cater to the wants and needs of students. Based off of student responses, the current incentives offered are not ‘incentivizing’ enough and do not encourage them to share a ride with others.

Based on these responses, it is clear that there needs to be a restructuring of the incentives offered by the university. My recommendation for this issue would be to first, increase the amount of cars that can qualify for the incentive, as I too agree that the amount of 20 is too small, when weighed against the population of students who drive to campus. Also, I would suggest that, to increase the number of potential participants, the required number of individuals required to be in the carpool be reduced. This will make this option much more convenient for car owners who cannot always find two other people to share their car with. Also, this incentive should be offered at all entrances into the university utilized by students, to avoid students having to come in through entrances inconvenient to them, as well avoid unnecessary traffic at entrances. Alongside these changes to the already existing incentive, I suggest the introduction and promotion of new incentives. For example, a convenient parking lot at a prime centered spot could be converted into a carpoolers-only lot, in which only those who participate in the incentives/program would



get the luxury of parking at this location. This could be very encouraging as it offers not only a free parking spot but only a convenient location with proximity to main buildings on campus. Understood, the issue of why students should be interested in free parking when they have already paid for a parking pass, may arise. For this reason, it is important to actively be receptive to student concerns, as will be discussed further in this chapter, and figure out solutions to this issue, while keeping them in the loop. A potential solution could be to waive the parking pass fee of those who are active members of the carpooling program, if it should become successful. This too, must be communicated to students as a potential offer, so as to gain trust and understanding.

## **10.2 Expansion of Bus Fleet at Peak Hours**

An issue raised by students was one of full buses. Below are some excerpts from survey comments, relating to the issue.

*“...it is never a guarantee that the bus that comes to my stop won't be full. More often than not the bus is full, which means I have to leave extra early so that if the first bus that comes to my stop is full, I can wait there for the next one and still not be late. Also, I would like to say that the best way to fix the parking situation on campus is to **FIX THE BUS SYSTEM. NOT JUST TO OFFER CARPOOL INCENTIVES! A BUS LINE IS THE MOST EFFECTIVE CARPOOL YOU CAN IMAGINE.** Nearly everyone I speak to who drives to campus does so more this year because of the increase in bus passengers but the lack of more busses to accommodate this. I find it absolutely **APPALLING** that despite this "20,000 by 2020" initiative, OCCT has not been able to add more busses to its fleet and that the amount of money the school gives to OCCT is **NOWHERE** online. This lack of transparency combined with this extreme failure to offer services that properly accommodate the student body is appalling to me. It's costing me -- and so many others -- hundreds of dollars in gas money that we cannot afford.”*

It was expressed that buses often get full earlier on their bus route, before all stops can be serviced. Therefore, students who are not as fortunate, and live closer to campus and therefore, more towards to the ending of the bus route often get left behind and have to

wait for the next bus, which is usually about 15-30 minutes later, or an hour on weekends. An increase of servicing buses at high peak hours could help to alleviate this issue, as well as improve the reliability of the bus system and foster the trust of students.

### **10.3 Added Transparency/Communication**

I believe that communication and collaboration between the university and student body are both vital to the success of a carpooling system, especially because car culture is so strong on university campuses. A survey respondent raised an important suggestion:

*“Hold an open forum on driving so students can voice their concerns”*

I agree with this concept of creating a platform where students can share their opinions and suggestions as well, in a well-organized manner. Before entire cities are planned for or changed, urban planners visit neighborhoods, hosting meetings, and allowing for open suggestions. Plans do not move forward without public acceptance. So, why is contribution so restricted on college campuses? This forum would give students the impression that their voice and well as money spent is important and valid in changes that occur at the university. To control for this, an organization could also be formed to serve as the liaison between the student body and university on transportation and parking matter. This way, students have a space they can express opinions and make suggestions that still reach university officials, more freely.

Following an improvement in communication between the university and student body, some things are to be expected, with the main being a demand for the construction of more parking space. Although, an understanding of the concept of induced demand, might better explain why this will never be a permanent solution. If you build it, they will

come – meaning that, an increase in parking space, which was supposed to cater to the population in need, will indirectly foster the idea to non-drivers that more people can now park easily, and they too, subject to their own car culture, will have reason to drive. In my opinion, some things, like induced demand, just cannot be worked around. I believe it is more important to understand that, at peak times, as the name suggest, parking will be more difficult, hence why other options exist. The same way if someone decides to leave work at 5:10pm and meets traffic, does not insinuate the need to expand the road, and neither does it mean that the transportation system of the city is terrible.

#### **10.4 Designation of Parking Lot for Long Distance Commuters**

It is recommended that a parking lot is designated for long-distance commuters, that is, students who live quite far away from the university and make a long commute to the university daily. These students do not have the resources to change their culture, at least not right away, as they do not have access to university buses nor readily available ride sharers. For these reasons, the dissatisfaction of this small population of students was expressed in the qualitative responses of the survey. This group of people put in effort to come to the university so I believe the university should be reciprocal of these efforts and directly cater to them.

#### **10.5 University Partnerships**

Other than the bike share and car share programs that Binghamton University currently offers, other opportunities exist. For example, the university could partner up with a company like Uber, which offers the ‘uberPOOL’ initiative. This promotes higher

occupancy driving as it provides door-to-door rides, while matching you with riders heading the same way, so as to share the ride and cost. The university could make a deal with a company like this, and subsidize the ride cost to all students on all commutes into and out of campus, as long as students are carpooling or sharing their ride with others. This would offer low prices and convenience, serving as an incentive to carpool.

### **10.6 Policy Changes**

Although changes in culture and generally long term and have to be promoted and incentive to take effect, sometimes a change in policy is necessary to allow or make way for this culture. The Parking and Transportation Services offices of the university are in a better position to identify the specifications and technicalities of these changes, as they have a much broader perspective, one this research cannot match. Although, a recommendation could be the limitation of vehicle ownership to students in their junior-year or senior-year. This could not only help to reduce the amount of cars on campus, but send an indirect message that a car is not a cultural symbol, but one of necessity, thereby promoting car culture change.

## **Chapter 11: Conclusion**

Overall, this study aimed to estimate the potential of carpooling and overall car culture change towards carpooling at Binghamton University. Based on student opinions and thoughts, this research analyzed why students drive to school over using other forms of transportation, the current satisfaction of student with campus parking, willingness to carpool, and comfort with carpooling. Topics like carpooling incentives, benefits of carpooling, and drawbacks of carpooling were also discussed.

The hypothesis of this study stated that by analyzing and identifying the viewpoints and attitudes of the student target population towards carpooling, alongside characteristics that likely influence or have an effect on this, it will be possible to measure and determine the potential success of a carpooling-based system at Binghamton University. Based on the results, this hypothesis has been confirmed. Using a combination of the findings, in terms of the different variables measured and analyzed, it is not difficult to see trends in student behavior, student opinions, and student wants and needs. With this detailed understanding of this specific population and recommendations made, it is quite feasible to create a carpooling system that will effectively cater to the majority.

Parking problems are always going to be a topic at higher institutions, because these will continue to expand exponentially in relation to the available parking space. Although, these can be managed and mitigated through the promotion of higher occupancy mobility, and a shift in car culture. As with any culture change, it will take time and effort to establish

a fully functional and efficient system in large institutions like universities so this is a long-term goal. Although, with the findings from this research, Binghamton University can work its way towards helping to solve the parking problem and improve the situation in the short-term.

## **Chapter 12: Further Research**

The next step in this research would be the running of a carpooling system pilot program. A main aspect of this program will be Travel Demand Modeling. This will require a thorough location analysis to identify a more specific location distribution of students. Travel Demand Modeling will involve trip generation (the number of trips to be made), trip distribution (where those trips go), mode choice (how the trips will be divided among the available modes of travel), and trip assignment (predicting the route trips will take). This model can be created using programs like Python, and will incorporate all of the results from this research, to cohesively test the success of a carpooling program at Binghamton University.

## **Appendix**



## **SURVEY QUESTIONS**

**To which gender identity do you most identify?**

- Male
- Female
- Transgender male
- Transgender female
- Gender Variant / Non-Conforming
- Not Listed \_\_\_\_\_
- Prefer not to answer

**What is your monthly income?**

\_\_\_\_\_

**How far is your commute from home to campus, on average?**

- 0.5 mile
- 1 mile
- 1.5 miles
- 2 miles
- 2.5 miles
- 3 miles
- Above 3 miles

**How often do you take public transportation to campus?**

- Once a week
- Twice a week
- Three times a week
- More than three times a week
- Never

**What is your main reason for driving to campus, over using public transportation?**

\_\_\_\_\_

**On average, how long does it take you, to find a parking spot on campus?**

- Less than 5 minutes
- 5-10 minutes
- 10-15 minutes
- 15-20 minutes
- Over 20 minutes

**On average, how satisfied are you with the parking spot you get on campus?**

- Very Satisfied
- Satisfied
- Unsatisfied
- Very Unsatisfied

**How often do others join you in the car on your commute to/from campus?**

- Always
- Most of the time
- About half the time
- Sometimes
- Never

**If you normally drive alone, how comfortable would you feel carpooling with another person, or group of the people on the commute to campus? (1-Very Comfortable and 5- Not Comfortable at all)**

- 1
- 2
- 3
- 4
- 5

**What benefits of carpooling would motivate you to join/host a carpool to campus?**

- Environmental benefits
- Reduction of traffic
- Reduction of parking crunch
- Avenue to build relationships and make connections
- Reduced car wear and tear
- Cost efficiency
- Other, please specify: \_\_\_\_\_

**If you wanted to join a carpooling system, through what medium would this be convenient for you? (Select all that apply)**

- Social media
- University website
- University Union information desks
- Kiosks in Paid Lot
- Parking Services office

**How often would you be willing to carpool with others in a week?**

- Once a week
- Twice a week
- Three times a week
- More than three times a week
- Never

**Would any certain characteristics of ride mates be relevant to you? Which? (select all that apply)**

- Gender
- Race
- Originality/Nationality
- Smokers/non-smoker
- Other, please specify: \_\_\_\_\_
- None

**In your opinion, what are some drawbacks of carpooling? (Select all that apply)**

- Fixed departure time
- Risk of not being picked-up (passenger)
- Uncertainty about fees
- Risk of not finding the passenger (driver)
- Safety risk
- Stops during journey
- Unwillingness to share a ride with strangers

**How important are these proposed incentives for carpooling to you?**

-Financial incentives

- Very Important
- Important
- Unimportant

-Free garage or paid lot pass

- Very Important
- Important
- Unimportant

-Custom Ride-mate pairing

- Very Important
- Important
- Unimportant

**Were you aware that Binghamton University offers the following parking incentive:**

Twenty vehicles per day that are traveling with three or more occupants will receive a free garage or paid lot pass by stopping at the Information Booth. The vehicle must have a valid parking permit and all individuals in the vehicle must show their University ID.

- Yes, I was aware
- No, but I am now aware

**Any additional comments:**

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## Bibliography

- Abramowitz J., Gabay D., Liu H., Merjia J., Mernitz J., Zhang Y. (2018). *Temporal Variation of Binghamton University's Parking*. Department of Geography, Binghamton University
- Alshuwaikhat, H., & Abubakar, I. (2008). *An integrated approach to achieving campus sustainability: Assessment of the current campus environmental management practices*. *Journal of Cleaner Production*, 16(16), 1777–1785.
- Barla P., Lapierre N., Daziano R. A, Herrmann M. 2015. *Reducing Automobile Dependency on Campus Using Transport Management: A Case Study for Quebec City*. *Canadian Public Policy*, Vol. 41, No. 1, pp. 86-96. University of Toronto Press
- Burns E. K. 1996. *Involuntary Mobility, Gender, and Travel Demand Management in Metropolitan Phoenix*. *Yearbook of the Association of Pacific Coast Geographers*, Vol. 58, pp. 9-27. University of Hawai'i Press
- Ciari, F. (2012). Why do people carpool? Results from a Swiss survey. Retrieved from <http://www.strc.ch/conferences/2012/Ciari.pdf>
- Cooper. B., Meiklejohn. D. 2003. *A New Approach for Travel Behavior Change in Universities*. 26<sup>th</sup> Australasian Transport Research Forum. Wellington, New Zealand.
- Correia G, Manuel V.J. 2010. *Carpooling and carpool clubs: Clarifying concepts and assessing value enhancement possibilities through a Stated Preference web survey in Lisbon, Portugal*. Department of Civil Engineering, University of Coimbra, Rua Luis Reis Santos, 3030-788 Coimbra, Portugal
- Dill, J. (2014, October 31). Early insights into peer-to-peer carsharing | Transportation Research and Education Center. Retrieved from <http://trec.pdx.edu/blog/early-insights-peer-peer-carsharing>
- Golob T. F. and Dobson R. (1974) Assessment of preferences and perceptions towards attributes of transportation alternatives. In *Behavioral Demand Modeling and Valuation of Travel Time* (Edited by P. R. Stopher and A. H. Meyburg). Transportation Research Board, Washington.
- Graves-Brown, Paul. 1997. *From Highway to Superhighway: The Sustainability, Symbolism and Situated Practices of Car Culture*

Social Analysis: The International Journal of Social and Cultural Practice, Vol. 41, No. 1, Technology as Skilled Practice, pp. 64-75. Berghahn Books

Hartgen D. T. (1974) Attitudinal and situational variables influencing urban mode choice: some empirical findings. *Transportation* 3, 377-392

Martino.S, Galiero.R, Giorro.C, Ferrucci.F, Sarro.F. 2015. *A Matching-Algorithm based on the Cloud and Positioning Systems to Improve Carpooling*. In: (pp. pp. 90-95). Knowledge Systems Institute

McKnight, M. (2015, October 12). Millennials, Car Culture, And The Automotive Industry. Retrieved from <https://www.theodysseyonline.com/millennials-car-culture-and-the-automotive-industry>

Moshe, B-A., & Atherto, T. (1977). Traffic and travel information. General specifications for medium-range pre-information via dedicated short-range communication. (n.d.).

Naughton, N. (2014, July 26). Millennials drawn to car-sharing services, but eventually, they buy. Retrieved from <http://www.autonews.com/article/20140726/R>

Prondzynski, F. (2008). And now for the real university issue: Car parking. Retrieved from <https://universitydiary.wordpress.com/2008/11/16/and-now-for-the-real-university-issue-car-parking/>

Shang, H., Lin, W., & Huang, H. (2007). Empirical Study of Parking Problem on University Campus. *Journal of Transportation Systems Engineering and Information Technology*,7(2), 135-140.

Stampfl, N. S. (2016). A Change of Role for the Automobile. Retrieved from <https://www.goethe.de/en/kul/mol/20692995.html>

Walsh, M. (2010). Gender on the Road in the United States. *The Journal of Transport History*,31(2), 210-230. doi:10.7227/tjth.31.2.6

Williamson, M. S. (2015, September 2). America's once magical – now mundane – love affair with cars. Retrieved from <http://www.washingtonpost.com/sf/style/2015/09/02/americas-fading-car-culture/ETAIL/307289990/millennials-drawn-to-car-sharing-services-but-eventually-they-buy>