Student attitudes toward incentives to reduce automobile use

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Studenters inställning till styrmedel och argument för att minska bilanvändande

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PREFACE

This thesis is made as a 20 credit points individual course and fulfils all the requirements for a Master of Science thesis in Biology at the department of Forest soils, within the program of Natural Resources, at the Swedish University of Agricultural Sciences. The study was performed in cooperation with the department of Political science, at Purdue University, West Lafayette, Indiana, U.S.A.

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CONTENTS

SUMMARY. Automobiles cause several problems in today's western industrialized society and there is wide agreement on the fact that automobile use needs to be reduced in this part of the world. Therefore, it is important to determine the incentives, arguments and polices that automobile users perceive to be most effective in making them drive less. It is also beneficial to identify which alternatives are likely to be attractive to car drivers. The majority of research and policy efforts in this field have been performed in Europe. However, the United States is the country that is most known for its automobile dependency. Consequently, the aim of this study was to identify useful incentives, arguments, policies, and alternatives for reducing automobile use, through survey research in the United States. The following sub issues were also considered: is there any public support for automobile use reduction and alternative modes of transportation in the U.S.? Is there a difference between Europe and the United States on the effectiveness of different incentives? Can religion be used as an argument to make Americans drive less?

A random sample of 411 college students at Purdue University (West Lafayette, Indiana) was obtained through "area probability sampling". A questionnaire containing 44 questions about how and why people drive, attitudes about driving and environmental problems, attitudes about different policies and incentives, and demographic factors was distributed to the respondents. The results showed that there is a potential for automobile use reduction and use of alternative modes in the United States. Europe and the United States were more alike than expected, consequently results from European studies can be taken advantage of in the United States. The most effective incentives identified by this study were to improve alternative modes of transportation, increase fuel and parking prices, provide health related arguments, reduce the number of parking spaces, and offer positive incentives such as "pay-as-you-drive insurance", "parking-cash-out", and "tele-working". Furthermore, religion would not be an effective argument to make students drive less. Specific recommendations for Purdue University would be to implement the existing "campus master plan" and reduce on campus traffic. In addition, Purdue University could focus on being a role model and create beneficial habits for the future.

KeyWords: automobile, reduce, incentive, United States, survey, students, attitudes, argument

SAMMANFATTNING. Bilar skapar många problem i dagens industrialiserade samhälle, och det råder enighet kring det faktum att bilanvändande måste minskas i västvärlden. Därför är det viktigt att veta vilka styrmedel, argument och policys som bilförare själva anser är mest effektiva för att få dem att utnyttja bilen mer sällan. Det är också viktigt att fastställa vilka alternativa transportmedel som är attraktiva för bilförare. Huvuddelen av den forskning som bedrivits kring detta tema har genomförts i Europa. USA är emellertid det land som är mest känt för sitt bilberoende. Därför var syftet med den här studien att identifiera de styrmedel, argument, policys och alternativa transportmedel som amerikaner anser är betydelsefulla. Studien genomfördes med hjälp av en enkätundersökning i Indiana, USA. Övriga frågeställningar som undersöktes var: är det möjligt att få stöd för en minskning av bilanvändande i USA? Finns det några skillnader mellan USA och Europa när det gäller vilka styrmedel som är effektiva? Kan man använda religion och tro som argument för att få amerikaner att köra mindre?

Ett slumpmässigt urval av 411 universitetsstuderande vid Purdue University (West Lafayette, Indiana) erhölls genom "area probability sampling". En enkät med 44 frågor om hur och varför man kör bil, attityder om bilkörning och miljöproblem, attityder om olika policys och styrmedel, samt demografiska uppgifter, delades ut till respondenterna. Resultaten visade att det finns en potential för minskning av bilanvändande i USA, samt att Europa och USA är mer lika än väntat när det gäller olika styrmedels effektivitet. Därför kan man dra lärdom av europeiska studier. De mest effektiva styrmedlen enligt den här studien var att förbättra alternativa transportmedel, höja priset på bensin och parkering, utnyttja hälsorelaterade argument, minska antalet parkeringsplatser samt erbjuda positiva incitament som "pay-as-you-drive insurance", "parking-cash-out" och "tele-working". Det fastslogs att religion inte är ett effektivt argument, åtminstone inte för studenter. Specifika rekommendationer till Purdue University är att implementera den "campus master plan" som finns och minska trafiken på campus. Dessutom kan Purdue University satsa på att vara en förebild när det gäller att skapa bra trender inför framtiden.

Sökord: bil, styrmedel, USA, enkätundersökning, studenter, attityder, argument

INTRODUCTION

It is no secret that automobiles cause several problems in today's western industrialized society (Kjellstrom et al., 2002; Gärling et al., 2002 etc.). Research and policy efforts have been put forth to try to deal with the problems. However, the automobile is too important to too many, so despite the efforts automobile ownership and use has kept increasing. Regardless of technological improvements, there is a consensus on the fact that automobile use needs to be reduced in the western countries for environmental, health, and land use reasons (Gärling et al., 2002). Therefore, it is important to determine the incentives, arguments and polices that automobile users perceive would be most effective in making them drive less. It is also beneficial to identify which alternatives are likely to be attractive to car drivers. The majority of research and policy efforts in this field have been performed in Europe and focused on how and why people drive or results of particular incentives. However, the United States is the country that is most known for its automobile dependency (Kenworthy & Laube, 1999), and few studies have explored which incentives drivers themselves say would be effective to make them drive less. Consequently, the aim of this study was to identify useful incentives, arguments, policies, and alternatives through survey research in the United States.

As previously mentioned, the majority of the research about automobile use has taken place in Europe. However, Europe and the United States are relatively different in terms of culture, the perception of governmental control, and land use policies. Considering these facts, it is important to ask the following questions: do people drive for the same reasons in the United States as in Europe? Are the same incentives likely to be effective? These issues need to be approached in different ways in these diverse contexts. For instance, Europe is more secularized compared to the United States, which frequently speaks about faith in both culture and politics (Zuckerman, 2004; Norris & Inglehart, 2004). Is it possible that religion and justice issues could be effective arguments to use in relation to automobile use reduction in the U.S.? Another difference is that Europe, to some extent, is already saturated when it comes to incentives to reduce automobile use (Jakobsson et al., 2002), while there is still great potential in the United States. However, are Americans willing to consider reducing their automobile use? Is it even possible to reduce driving in the U.S. with any reasonable incentives?

This study was performed with college students at Purdue University in Indiana. Students are an interesting target group since they are frequent automobile users, despite that they generally are fit and healthy, do not have a lot of money or any children, and usually live close to campus. Why do they drive? Can this be changed? Students are also an important part of future trends, which adds to the benefits of studying and trying to influence this group. Purdue University's location in the state of Indiana is attractive for this study because it is rural, conservative, automobile dependent, and in the vicinity of the "Bible belt"[1]. Furthermore, Purdue University is interesting for this study because of the University's long term aim to reduce traffic on campus.

Some limitations of the present study should be pointed out. When generalizing the results it is important to have in mind that this study is representative only for students with cars. Therefore, generalizing to other groups or even to students without cars is not correct, since the subjects were not representative of the general population. There is also a discussion about whether the method "area probability sampling" is simple random sampling or not. Nevertheless, since so many of the results are consistent with previous research, it is reasonable to assume that the findings are accurate and can be generalized to some extent.

Another problem in this study is to compare the United States to Europe, since the differences between the states and countries within the continents can be substantial (Norris & Inglehart, 2004).

Figure 1. Purdue campus, bell tower and fountain (Purdue, 2005).

[1] An area noted for religious fundamentalism, specifically, parts of the American South and Midwest (Appendix 1; Answers, 2005).

However, this comparison has frequently been made in previous research in this field, therefore it is reasonable to assume that there are fundamental differences between the United States and Europe (Guiliano & Narayan, 2003; Kenworthy & Laube, 1999; Newman & Kenworthy, 1992; Pucher, 1995a,b; Pucher, 1998; Pucher et al., 1999). Nevertheless, it is important to keep in mind that this study was performed in the state of Indiana in the U.S., and whenever possible the European country in question will be mentioned.

Following this introduction, the paper begins with a background study of the negative and positive effects of automobile use and summarizes previous research in the field. Moreover, the background study constitutes the foundation for the questions asked in the questionnaire. The methods section describes the survey design and distribution method. Subsequently, in the results section, the respondents' answers are analyzed, discussed, and divided into the following categories: how and why people drive, attitudes about driving and environmental problems, important incentives and policies, and demographic factors that seem to be influential. Finally, the conclusion determines the main findings of this study and provides policy suggestions.

BACKGROUND

Negative effects

Negative effects of automobile use are well known and generally recognized. Cars contribute to air pollution, safety, health, land use, equity, and justice issues. These problems are all strongly associated with a variety of significant environmental damage and human health problems. In order to decrease the negative effects, the determinants of automobile use, such as technological, institutional, psychological, and financial factors, have been widely studied, especially under European conditions.

Air pollution

Automobiles create emissions of carbon dioxide [CO_2], oxides of nitrogen [NO_X], oxides of sulphur [SO_X], ozone [O_3], carbon monoxide [CO], volatile organic compounds [VOCs], air toxins (e.g. hydrocarbons, aldehydes) and particulate matter [PM] from tires and diesel engines etc. These pollutants cause depletion of the ozone layer, acidification, soil and water pollution, adverse effects on crops, deterioration of buildings, reduced visibility, and potentially even climate change. Finally, one of the main concerns with these pollutants is health issues such as respiratory and cardiovascular diseases, cancer, morbidity, and loss of quality of life (Gärling et al., 2002; Priemus, 1995; Johansson, 1999; Pickrell, 1999; Wilson & Spengler, 1996; Kjellstrom et al., 2002; Romilly, 2001; Whitelegg, 1997).

In the past decade, global warming and climate change[2] has been a highly debated potential effect of air pollution. Emission of greenhouse gases, especially carbon dioxide from motorized traffic, is considered to be one of the key causes (Lanzendorf, 2002), since traffic contributes to at least one third of the CO_2 emissions (Whitelegg, 1997). Some of the possible effects of climate change are crop damage, spread of tropical diseases, flooding, hurricanes, drought, and reduced biodiversity (Environmental Defense, 2005). An additional problem with these effects is that they are unequally distributed. Wealthy nations cause most of the problem, while poor nations are most likely to be affected, since they lack the societal structures and monetary funds to prevent or remedy the negative effects (Whitelegg, 1997). Due to the diversity of these problems, it is interesting to see which of these effects is likely to motivate people to drive less.

Safety and health

Health effects from air pollution can occur even at exposure levels below those stipulated in current air-quality guidelines. In general, it is children and the elderly that suffers most often (Kjellstrom et al., 2002). According to the American Lung Association (2002), air pollution costs billions of dollars every year in health care and lost productivity. In some Western countries, it is even estimated that automobile emissions kill twice as many people as car crashes each year (Künzli et al., 2000). This shows that the public health risks of air pollution are considerable, and benefits from clean air policies are large (Künzli, 2002).

Isolating the effects from individual pollutants is complicated since they all co-exist in the air, and vary significantly due to weather patterns (Kjellstrom et al., 2002; Künzli, 2002). However, it has been noted, that very small particles (e.g. emissions from old diesel engines) are more likely to cause health problems, since they penetrate further into the lungs than

2 Definitions (EPA, 2005a):

Greenhouse gases: Gases such as water vapor, carbon dioxide, nitrous oxide, and methane, make the Earth warmer by trapping energy in the atmosphere. These gases are emitted naturally, but can also be anthropogenic.

Climate change: Climate is the long term average of a region's weather patterns, climate change represents a change in these long term patterns.

Global warming: This refers to an average increase in the Earth's temperature. The concern is global warming caused by human activities which increase the amount of greenhouse gases in the atmosphere, and may cause climate change.

larger particles (Kjellstrom et al., 2002). It has also been recognized that exercising in polluted air or in proximity to traffic, which is likely to occur in the U.S., amplifies the negative effects, since the depth and frequency of breathing is increased (Wilmore & Costill, 1994; The American Lung Association, 2005).

Aside from the negative health effects caused by air pollution, excessive automobile use contributes to a sedentary lifestyle. This is related to the obesity epidemic that is prevalent in the United States and other countries today (Wilmore & Costill, 1994). Lack of fitness of automobile users can lead to significant health problems. Therefore, the fact that many households are becoming automobile dependent and do not even consider alternative modes of transportation, even for shorter trips, is reason for concern (Mackett, 2003). In order to reduce automobile use, would it be possible to motivate drivers to drive less for health reasons?

Auto accidents are another important part of health issues related to automobile use. Despite a large number of attempts at improving traffic safety worldwide, fatalities and injuries are still increasing with tremendous individual and societal costs (Gärling et al., 2002). According to the Federal Highway Administration (2005), in 2003 there were 6,328,000 auto accidents in the United States, resulting in 2.9 million injuries and 42,643 fatalities. The cost of accidents in 2000 was an estimated $231 billion (Bureau of transportation statistics, 2004).

Land use, congestion, and other problems

Other adverse effects of automobile use include noise, odor, congestion, and extensive use of land for roads and parking spaces. The effects of traffic congestion include increased air pollution, because of idling, and loss of work or leisure time. In Atlanta, Georgia, estimations showed that the region burned 239 million gallons of gasoline annually due to congestion, and in addition, it cost the average person $915 a year in lost time (Henderson, 2004). Consequently, when everybody uses a car all the time, the benefits of automobile use are highly reduced. In an attempt at reducing, if not solving the congestion problem, increased use of land for roads and parking spaces has invaded agricultural, ecological, and recreational areas (Gärling et al., 2002; Schwanen et al., 2004). Unfortunately, this is not even the solution to the problem. Research shows that new roads actually generate extra traffic, rather than relieving congestion (Goodwin, 1997). Moreover, traffic infrastructure is an intensive and inefficient use of land, since the roads and parking lots take up a great deal of space, even when they are not used (Ewert & Prskawetz, 2002; Jain & Guiver, 2001). They also create barriers in the landscape, which isolate habitats and reduce the viability of plants and animals. This may cause extinction of species and reduce biodiversity, which is important to the health of ecosystems. Biodiversity can also be reduced further by air pollution and climate change (Whitelegg, 1997; Martens et al., 2003).

An automobile dependent society has social implications as well. The fact that the car has become a necessity rather than a choice in many places in the United States creates social exclusion, where the freedom of choice is provided only to those with cars. Locally available services are lost to everyone, affecting especially women, children, and the elderly (Jain & Guiver, 2001). People who want to walk, ride bikes, or use public transportation are unable to do so because of heavy traffic, long distances, and lack of safety or convenience of alternative modes of transportation (Saelensminde, 2004). Finally, the environmental consequences impact all people, and not just the automobile users, which can be seen as unjust.

Technological improvements are a popular solution to the problems caused by automobile use, and they can alleviate some of the negative effects. However, they can not solve all of them. Therefore, these kinds of measures are not included in this study. In most cases, the gains from technological solutions or further road construction are overtaken by continued growth of automobile use and vehicles that are more powerful. Therefore, it is widely accepted that reducing automobile use is a crucial part of limiting the negative effects (Mackett, 2002; Gärling et al., 2002; Priemus, 1995; Steg & Tertoolen, 1999; Black et al., 2001; Byrne et al, 1999). In the case of alternative fuels, to date, nothing can compete economically with gasoline and diesel. According to Johansson (1999), the only way to make alternative fuels competitive is to value the environmental impacts of emissions monetarily.

Positive effects

Despite the numerous negative effects of automobile use, the positive effects are plentiful as well. That is why reducing automobile use is such a struggle. The car is versatile, fast, always available, and comfortable. It provides freedom, less stress, less planning, and it protects people from different weather conditions. The automobile gives one privacy, status, personality, enjoyment, security (Priemus, 1995; Hagman, 2003; Steg & Tertoolen, 1999), and makes it possible for people to live scattered, participate in numerous activities on their free time, and spend time with friends and family. Accordingly, the car provides both a social and material lifestyle that no alternative can compete with. Therefore, no matter the negative consequences, the car will not easily be given up (Sheller, 2004). The car is so important to many, that according to research by Gärling et al. (2002), reducing automobile use may even cause negative psychological side effects for people. Therefore, the following question is asked: is it even possible to motivate

people to give up all of these benefits, and if so, how? It is also important to evaluate the trade offs that car use reduction measures entail, and choose the most beneficial ones with the least negative side effects.

Many studies have been carried out, especially in Europe, to try to understand the main determinants of driving. In a Dutch study by Tertoolen & Verstraten (1995) the subjects were asked to rank the most important aspects of transportation. The results showed that neither the environment, nor monetary costs are of great importance. The ranking of the most important aspects were: (1) rapidity, (2) independence, (3) comfort, (4) health, (5) monetary costs, (6) the environment, and (7) safety. Consequently, it is important to give non environmental motives for not driving, such as increased personal health (Nordlund & Garvill, 2003). However, when respondents in a Swedish study were asked about the most frequent reasons for reducing automobile use, money, and environment were most important and physical exercise came in second. The most frequent reasons for not reducing automobile use were the following: unnecessary/unable to reduce car use more, lack of motivation or alternatives, time pressure, unwanted suppression of activities, discomfort, less fun, long traveling distances, carrying cargo, car needed for work, bad weather, and finally convenience (Jakobsson et al., 2002; Mackett, 2003). It is interesting to see if these European reasons are consistent with reasons in the United States.

Attitudes about driving and environmental problems (psychological and behavioral aspects)

In order to reduce automobile use, people have to change their behavior. This is not easy, because people do not tend to make rational and optimal decisions (Steg & Tertoolen, 1999). People's choices of travel mode are not only due to external factors, such as service level of different alternatives and monetary costs, but also to psychological factors, such as problem awareness, values, morals, habits, attitudes, and *social norms*[3] (Fujii & Kitamura, 2003; Steg et al., 2001). Therefore, many researchers have focused on these issues and asked questions that reveal these factors.

Problem awareness and values

Consumers have begun to limit their impact on the environment, especially in California and Europe (Sheller, 2004). When it comes to this pro-environmental behavior, problem awareness and values have been found to be important (Steg et al., 2001). People who are aware of the problems are more likely to be willing to cooperate. In this context, education is of great importance. The more *eco-centric*[4] values people have, the more morally obligated they feel to cooperate (Nordlund & Garvill, 2003). For instance, one thing that people in general seem to value is parks and green space (Mills, 2005). Therefore, preserving recreational areas can be an argument for reducing automobile use, since people might not realize that less green space is a trade-off to automobile use.

Morals and habits

The mix of the both positive and negative effects of automobile use ends in what social scientists call a *social dilemma*. Economists call it *externalities* and *tragedy of the commons*[5]. The problem with automobile use is that the disadvantages of driving mainly affect others, while the advantages affect oneself. The negative contribution made by each individual seems negligible, so it is hard for a driver to sacrifice immediate personal gains in order to reduce long term collective environmental damage costs (Nordlund & Garvill, 2003; Priemus, 1995; Steg & Tertoolen, 1999; Hagman, 2003; Rouwendal et al., 1995). It has also been found that scientific facts about the negative effects of automobile use are likely to be seen as relative and negotiable, since they are produced by others far away, while personal experiences of the advantages are seen as unquestionable and absolute (Hagman, 2003).

The social dilemma can also be seen as a moral issue, and doing what is best for every person is the "right" action. People who see automobile use as a moral issue are more likely to reduce their amount of driving. According to a Swedish study, most people were willing to reduce their automobile use, and saw it as a moral obligation (Nordlund & Garvill, 2003). However, being willing to do so, and actually doing it, are two different things. Several European studies have shown that even if people are aware of the environmental problems, they do not reduce their automobile use (Steg & Tertoolen, 1999; Black et al., 2001). Nonetheless, it may be important to emphasize the moral aspects of automobile use and talk about justice issues, for example between developed and undeveloped countries.

[3] *Social norms* are the expectations and actions of others.

[4] *Eco-centric* is the belief that the environment has an intrinsic value, regardless of humans. In contrast, *anthropocentric* is the belief that the environment has a value because it is useful to humans

[5] *The tragedy of the commons* is a conflict between individual interests and the common good. The cause is that when individuals use a public good, they do not bear the full cost of their actions (they cause *externalities*). Therefore, individuals do what is best for them short term and exploit more than their share of public resources and ignore problems that he/she causes others. If the majority of individuals follow this strategy, public resources will be overexploited and everyone will be worse off in the end (Wikipedia, 2005).

One of the main reasons why it is so hard to reduce automobile use is that for most people it is a habit. There is no longer a conscious, rational evaluation of pros and cons of different alternatives (Jakobsson et al., 2002; Bamberg & Schmidt, 2003). Therefore, changes in the external environment or rational arguments are usually inefficient (Gärling & Axhausen, 2003). Once car dependency is established, it is very difficult to alter (Steg & Tertoolen, 1999; Garvill et al., 2003; Gärling et al., 2002). Mackett (2002) found that these habits usually are formed early in life, and car dependency at an early age will make other modes of transportation unlikely in the future. The same goes for attitudes towards different modes of transportation (Bamberg & Schmidt, 2003). As a result, it is important to encourage and make young people try different modes of transportation.

In order to change established habits, people usually have to be forced to break these habits so they can re-evaluate their choices. Typically, a radical change is needed for this to happen (Steg & Tertoolen, 1999; Gärling & Axhausen, 2003; Garvill et al., 2003), however, this change does not necessarily have to be permanent. Fujii & Kitamura (2003) and Fujii et al. (2001) found that even a temporary change in the transport system, such as a temporary free bus ticket, closing of a highway, or road tolls, may cause permanent changes in behavior. This knowledge is of great benefit for policy and decision makers. Because a temporary structural change is cheaper, more feasible, and public acceptance will be higher since the change is transitory.

Attitudes and social norms

Other important psychological factors are attitudes about freedom and social norms.

Automobility is a source of freedom and individualism (Urry, 2004), and this is not a by-product, but often the main motive for car ownership (Diekstra & Kroon, 2004). Therefore, individualists who have a strong belief in personal freedom may dislike reducing automobile use, especially if they see choosing to use a car as a right (Schlag & Teubel, 1997; Gärling et al., 2002; Tertoolen & Verstraten, 1995). The United States is known for honoring freedom and individualism. Therefore, automobile reduction measures may face a great challenge in this respect, and it is valuable to know how common it is that people view automobile use as a right.

The expectations of others, and class differences can also be strong predictors of the use of alternative modes of transportation (Tertoolen et al., 1998; Bamberg & Schmidt, 2001; Steg & Tertoolen, 1999). Social norms are particularly important to young people, as will be mentioned below in the section about students.

Provision of information and attitudes

As mentioned above, attitudes and problem awareness are linked to willingness to cooperate and reduce automobile use. Therefore, politicians and scientists have presented a variety of reasons as to why it would be beneficial to limit automobile use. Some examples are health effects from air pollution, increasingly sedentary lifestyle, national security issues from oil dependency, and possible effects from global warming and climate change (Environmental Defense, 2005). In this context, it is important for politicians and decision makers to know which of these arguments are most likely to motivate and affect people.

In an individualized society, environmental concerns are likely to be felt the most, the closer they come. Typically, this happens when health issues impinge on ones body (Jacobs, 1999). Therefore, health related arguments are likely to be effective. Local arguments are expected to be effective as well, since people tend to value their personal environments the most. On the other hand, global environmental problems are distant, abstract, and hard to link to personal actions, which makes them easy to ignore (Machnaghten, 2003). As a result, it is important to try to link global issues to the local environment. However, feeling concerned about something, and changing one's behavior is not necessarily the same thing. Hinchliffe (1997) states that even experiencing effects of local environmental problems may fail to engage behavioral change.

Even if providing information is a common approach, research shows that information about negative consequences of automobile use, and attempts to increase environmental awareness, are not likely to be effective (Nordlund & Garvill, 2003; Rose & Ampt, 2001). Possible reasons for this are habit, *cognitive dissonance*[6], and the fact that behavior influences attitudes more than the other way around (Tertoolen & Verstraten, 1995; Jain, 1998).

Cognitive dissonance is important in the case of car users who drive often, but also have a positive attitude towards the environment. If they are reminded of the problems caused by automobile use, they are likely to start thinking that the environment is less important and point out that others are more responsible for the problem than themselves (Tertoolen &

[6] *Cognitive dissonance* is an inconsistency between attitudes or between attitudes and behavior. For example, if ones actions are not consistent with ones values. This inconsistency is psychologically uncomfortable, so people try to reduce it either by changing attitudes or changing behavior. Regarding environmental problems, research has shown that if people are presented with information about problems caused by automobile use, they are more likely to change their attitudes and decrease their environmental awareness, than they are to change their behavior (Tertoolen & Verstraten, 1995; Tertoolen et al., 1998; Steg & Tertoolen, 1999).

Verstraten, 1995). Regarding influencing attitudes, social researchers have revealed that the most efficient way to change people's attitudes is to force them to change their behavior. This differs from the common approach that information and a change in attitude will lead to a change in behavior. In an English study by Jain (1998), respondents confessed that it was only after the lifestyle change had occurred that their environmental awareness grew. Therefore, in order to change people's attitudes, the most efficient way is to make them change their behavior. Consequently, decision makers should be aware of that forcing changes upon people can be a positive thing.

Furthermore, it has been concluded that mode of transportation influence attitudes. Steg (1996) and Golob & Hensher (1998) found that the more people use their cars, the more positive their attitude is towards car use, the less serious they perceive the problems of car use, and the less favorably they evaluate policy measures aimed at reducing car use. Obviously, attitude influences choice of mode as well, but this relationship was incomplete. The studies concluded that attitudes that are consistent with mode choice are reinforced by the choice, which supports the fact that behavior has a strong influence over attitude. Consequently, commuters who use public transportation are more likely to support environmental policies (Golob & Hensher, 1998).

Research shows that several people hold excessive negative beliefs about public transportation and other modes of transportation. These opinions depend more on psychological factors such as beliefs, attitudes, and habits, than on objective evaluation or experience (Fujii et al., 2001). In a study of Japanese University students, Fujii & Kitamura (2003) concluded that a temporary structural change, can force people to use another mode of transportation, and correct these negative beliefs with actual experience. Therefore, it is important to find out which instances that could make people try alternative modes of transportation.

Despite the low effectiveness, providing information is an important prerequisite for implementing policy measures. In this case, it can create greater appreciation and understanding of the policies that are aimed at reducing automobile use (Loukopoulos et al., 2004; Tertoolen & Verstraten, 1995; Tertoolen et al., 1998; Steg & Tertoolen, 1999; Schlag & Teubel, 1997). Therefore, it is important for decision makers to be aware of how to best motivate and justify a reduction in automobile use.

Incentives and policies

It is difficult to change people's attitudes or choices. Therefore, some level of policy incentives or disincentives has to be present in order to reduce automobile use. The pay-off structure for people simply has to change (Gärling et al, 2002 & Meyer, 1999). In appendix 2 a list of possible incentives is provided.

For a decision maker to make the best possible decision about how to reduce automobile use and allocate scarce resources, it is important to have knowledge about incentives' effectiveness and usefulness. Widely proposed policies for reducing the adverse effects of automobile use include: physical changes, such as closing out automobile traffic; improving alternative modes of transportation, such as public transport, biking, or walking; decreasing pollution with technology; law regulation; economic incentives and disincentives; information; education; and changing the relative locations of homes, workplaces, shopping and recreational facilities so that travel distances are reduced; institutional or organizational changes, for instance, flexible work hours and working from home (tele-working). These policies differ in effectiveness, cost, time scale, technical feasibility, public acceptance, and political feasibility (Gärling et al., 2002; Priemus, 1995; Steg & Tertoolen, 1999; Vlek & Michon, 1992).

Policy makers and scientists usually divide these policies into different groups. One way is to separate them into price or quantity controls. First, the *price* of car use can be raised through appropriate taxes, or the price of other modes of transportation can be lowered through subsidies. Secondly, policy makers can use non-price or *quantity controls* to reduce car use. These can include the creation of bus lanes and the removal of parking spaces. In general, quantity controls are less efficient (e.g. produce a lower social welfare) than price changes, and subsidies are less efficient than taxes (Romilly, 2001). Another way to group the policies is into push and pull measures. Car use can be made less attractive by *push* measures, or the use of alternatives may be stimulated by *pull* measures. Push measures may restrict people's freedom of choice; while pull measures do not (Steg & Tertoolen, 1999).

Public support

In policy making, public support is an important factor, and measures that restrict or influence automobile use can rarely count on any extensive support. On the contrary, the more effective policies are, the more resistance they evoke (Diekstra & Kroon, 2004). Research has concluded that a coercive change is likely to be effective (although not necessarily cost effective) but may not be publicly accepted. On the other hand, a voluntary reduction in car use may gain public acceptance, but is not likely to be effective. People are unwilling to change their daily routines, and if they have to, the changes will be as small as possible. The best way is to introduce a policy step by step, since a gradual reduction is easier to achieve and become accustomed to than a sudden, large and/or complete reduction in automobile use. A sudden

coercive change can result in stress, anger, resentment (Gärling et al., 2002), and even have the opposite effect from what was desired (Tertoolen et al., 1998). Therefore, knowledge about different target groups' opinions and public acceptance is important.

Financial measures

Car availability and vehicle type is mainly a function of the costs of ownership and use (Guiliano & Narayan, 2003). Despite this, the price sensitivity for the use of the car is relatively low. In general, drivers do not consider the true costs of automobile use. Usually only variable costs, such as fuel prices, are taken into account. The fixed costs, such as insurance, or the cost of external effects, such as pollution, are usually ignored. As mentioned above, the external negative effects of automobile use are considerable, and if they are not included in the analysis of automobile use, it will lead to poor decisions on community level (Romilly, 2001). The common practice to solve this problem is to set a price on the external effects and create a market. This often entails an environmental tax (e.g. fuel tax, road pricing, parking fees), which internalizes these externalities and makes the driver consider the external costs, since they are now part of the price that is paid (Priemus, 1995; Kostas & Basbas, 2004; Rouwendal et al., 1995). This type of regulation has many benefits. First, research shows that financial measures usually are cost effective, and the benefits from reduced external effects outweigh the costs (Pickrell, 1999). Secondly, even a low tax provides substantial funds that can be used for improvement of alternative modes or cleaning up pollution (Anderson & Leal, 2001; Mackett, 2002). Thirdly, this type of regulation can be considered fair, since the costs of the environmental impacts are paid for by the ones that are responsible for them, following the so called *polluter pays principle* (Kostas & Basbas, 2004).

According to Priemus (1995) price measures have to be increased considerably in order to be effective, and increasing fuel prices is the most effective option. Fuel price is the most effective price incentive, since it is usually taken into account by drivers, and affects both the number of miles traveled and vehicle type. It is also unlikely to cause any implementation problems since such a tax is already implemented in all western countries (Rouwendal et al., 1995). In a Dutch study, Priemus (1995) states that if fuel prices are doubled, they can reduce traffic by 30-40% long term. On the other hand, a significant reduction in the price of public transportation is not as efficient. In the first place, it will only lead to a use that is more intensive by the existing users. It is also possible that there will be a switch from non-motorized forms of transport to public transportation, which is not beneficial (Priemus, 1995). However, these findings are not consistent with studies geared toward students (see the section about students below, p. 17).

Even if economic incentives and disincentives are substantial, they can fail to be efficient (Jakobsson et al., 2002). In terms of financial measures, it is often assumed that people's responses will be rational, and that they will use the option with the highest utility and the lowest cost. Nevertheless, financial considerations are not the main determinant of car use. As was previously discovered, many psychological factors are important, as well as benefits such as speed, comfort, and versatility. These are highly valued and worth paying for. Feasible alternatives must also be available, otherwise car use can not be reduced by increasing prices (Kostas & Basbas, 2004). Common responses to financial measures, especially road tolls, are that people just pay the extra cost, or avoid the roads with charges. A higher fuel price is generally compensated for by buying smaller and more fuel efficient vehicles (Steg & Tertoolen, 1999; Jakobsson et al., 2000; Loukopoulos et al., 2004). In a Swedish study by Hagman (2003), almost all interviewees agreed that it is important to reduce automobile use, and despite this, they disliked increased fuel prices and said that it was not likely to make them reduce their own car use. This is consistent with British results from Terzis et al. (1995), that found that the most common response to increased fuel prices was no change at all. However, changes such as reducing mileage, switching to other travel modes, and changing vehicle type were also frequent responses. The overall effect on ownership was, and usually is, small. Therefore, despite high fuel prices in Europe, car ownership has continued to increase due to overall economic and social trends (Rouwendal et al., 1995).

Another barrier to automobile use reduction, especially in Europe, is people who have a positive attitude toward measures to reduce driving. If people feel that they have already reduced automobile use, increased costs may lead to protests rather than increased motivation to reduce car use (Jakobsson et al., 2002; Tertoolen et al., 1998). Therefore, opponents to reductions in automobile use are more likely to be susceptible to financial incentives, because they have not already reduced their automobile use (Bamberg & Smidth, 2001). This is one reason why the reduction potential still may be substantial in the United States.

Innovative financial incentives are discussed and increasingly available on the market today. Some examples are increased registration fees, pay-as-you-drive insurance, tele-working, or parking-cash-out options (Diekstra & Kroon, 2004; Environmental Defense, 2005). These measures may guide vehicle ownership and reduce distance traveled. Vehicle registration would be paid in proportion to how much the vehicle pollutes, and insurance would only be paid for as much as the vehicle was actually used.

Employers could offer their employees to work from home several days per week or provide them with a monetary bonus for not driving to work (Environmental Defense, 2005). In order to research the potential of these options, it is important to ask the public how attractive these options are, and how likely they are to be accepted.

Improving alternatives

It is important to identify the alternatives that are likely to be attractive to car drivers (Mackett, 2003), so that money and resources can be focused on the best choices. In trying to reduce automobile use, there is a wide range of options that can be chosen such as staying at home and thereby reducing the number of trips (trip suppression), coordinating activities so that fewer trips have to be made (trip chaining), using electronic communication to do different tasks as well as work from home (teleworking), ride with others (car pooling), travel to closer destinations, or using other modes of transportation. Households may also choose long term strategies such as moving to another residence (Loukopoulos et al., 2004; Ewert & Prskawetz, 2002), even if this response is not very common (Gärling et al., 2000).

The logistics of certain cities and towns can make it very difficult to reduce car use, especially in the United States, where automobile use is often the only option. According to a Dutch study by Priemus (1995), public transportation is not an alternative for 80% of all drivers, due to its absence or poor service. In contrast, a British study by Mackett (2003) concluded that 78% of the respondents' trips could be made by another mode of transportation.

In order to increase drivers' use of alternatives, their habits must be broken, and contextual factors must change. The car must be made less attractive, for example, by increasing the costs, and alternative modes must be improved (Garvill et al., 2003). The most efficient way to increase public transportation is to restrict private car use and raise its costs, rather than subsidizing public transport fares heavily (Kenworthy & Laube, 1999). It is important to realize that it is not possible to start with other modes in order to reduce automobile use: one must start with the automobile itself (Priemus, 1995). After this realization, the competitiveness of public transportation, walking and bicycling has to be optimized. In doing so, cars should become slower, less powerful and less fun, while other modes should become faster, safer, and more attractive (Diekstra & Kroon, 2004). Moreover, reducing speed of traffic is an important contribution to both safety and pollution reduction (Priemus, 1995; Schwanen et al., 2004). It is important to empower pedestrians and cyclists by changing and enforce traffic laws so that the weaker always has priority over the strong (Diekstra & Kroon, 2004). A Swedish example is that cars legally must stop when a pedestrian wants to cross the street.

Public transportation

In general, people do not seem to have a strong aversion against substituting the car for other modes of transportation (Gärling et al., 2000). In a British study by Mackett (2003) improving public transportation, walking, and cycle facilities, were mentioned as actions that could reduce automobile use. These alternative modes were also the ones most likely to be used. A Swedish study confirmed this by finding public transportation and car pooling the most attractive alternatives (Gärling et al., 2000). It is interesting to see if these answers are reproduced in study performed in the United States.

Improving public transport is the specific action which drivers in general say is most likely to get them out of their cars (Mackett, 2003). This alternative seems feasible to implement as well. However, it might not be the most effective option to reduce automobile use. According to De Vlieger et al.'s (2002) study in Belgium, car pooling and tele-working are more effective, even if tele-working is a limited possibility for various jobs. The main disadvantage with improvements in public transportation is that this type of measure has a very high cost per reduced car mile. It is also impossible to improve public transport so it competes with the car in all respects. Therefore, when improving public transportation, attention has to be focused on specific situations and target groups (Priemus, 1995).

Despite its flaws, an improvement in public transportation (and bike logistics) is necessary in order to reduce extreme automobile dependency. For example, improving schedule predictability, reliability, frequency, enhancing privacy, improving safety and convenience are desirable changes. People do not like uncertainty, and want to feel safe and in control, so these needs have to be met (Gärling et al., 2002; Priemus, 1995). Drivers have also said that a weather improvement could increase the use of alternative modes. Obviously, weather can not be improved, but the exposure can be limited by providing more bus shelters (Mackett, 2003).

Travel today is often perceived in time spent rather than distance covered, and many people value time more than money (Schwanen et al., 2004). Consequently, the traveling time ratio between the car and public transport plays a critical role in the consumer's choice of transport (Priemus, 1995). It is interesting to obtain more information about exactly how important time and other aspects are. If the alternatives were as fast as the automobile, would that be sufficient, or would they have to be faster? Is price most important, or are frequency and other features just as important?

The mode that best can compete with automobile use is high capacity urban rail systems. With the new high speed trains, it can be considerably faster than driving. This mode is also more likely to operate with profit. Therefore, it is important to see how willing drivers are to use this mode of transportation. The main disadvantages are that rail systems are costly and un-flexible, compared to busses (Kenworthy & Laube, 1999). Another problem found in an Australian study was that a newly introduced rail system did not substantially decrease automobile use; it just transferred the bus users to the rail system (Luk, 2003). This is an example of the fact that the habitual nature of driving diminishes the objectives in improving other modes (Gärling et al., 2002).

It is of great importance to find ways in which public transportation can combat the car, and use advertising campaigns to make people aware of the benefits of alternative modes of transportation (Mackett, 2003). One way can be to offer public transportation with possibility of working while riding (Diekstra & Kroon, 2004). In Sweden, public transit has been marketed by showing the advantage of being able to do other things while traveling, and use the time more efficiently compared to driving (SJ, 2005). Could this be a possible way to market public transportation to Americans as well? Another aspect that is beneficial to encourage is multimodality. For example, combining car and bus, or bike and bus, by improving park-and-ride facilities and adding bike racks to busses (Priemus, 1995). In some countries, such as Germany and Sweden, a number of train stations have staffed bike parking facilities that offer security, service and rental (Pucher, 1998).

Sometimes, reasons that are less obvious can prevent the use of other modes of transportation. For example, social norms and class differences can be barriers for public transportation. In some states in the United States, public transportation is seen as a low class mode of transportation. However, this can be a direct consequence of how efficient it is. Countries such as Germany, Switzerland, Austria, and the Netherlands have among the highest per capita incomes in the world, and still public transportation is so efficient that it is chosen over the car by most people (Pucher, 1995b; Kenworthy & Laube, 1999). This efficiency of public transportation is highly dependent on supportive public policies that restrict private car use, raise its costs (Pucher, 1995b), and promote urban density (Kenworthy & Laube, 1999).

Even if public transportation has both pros and cons, there are overall net benefits from car to bus transfer. Policymakers can present a stronger case for policies that discourage car use by showing these benefits in a cost benefit analysis (Romilly, 2001).

Bicycling and walking

Bicycling and walking are non-polluting, cheap, and healthy. Therefore, these modes are of great benefit to the society. In order to increase the volume of bicycling, and change commuting from car to bike, both pro bike policies and anti auto policies are necessary.

According to a Norwegian study by Saelensminde (2004), motorized traffic prevents people from bicycling or walking as much as they would otherwise prefer. This creates high external "barrier costs", since it is an unrealized benefit to society. Therefore, it is important to improve walk and cycle options with regards to convenience and safety, because these factors influence choice of transportation. Separate bike paths and lanes need to be provided, since few people are willing to ride their bikes without these types of measures. More street lighting and wider sidewalks would make people feel safer as well. In addition, it is important that schools and workplaces have on-site changing and cycle storage facilities (Mackett, 2002). By creating trails for cycling, travel time could be reduced considerably compared to cycling on regular sidewalks, which would increase this mode's competitiveness. If walking and cycle track networks with safe crossing facilities are constructed, as much as 50% of school bus transportation would not be needed, and 50% of new pedestrians and cyclists would see improvements in their health (Saelensminde, 2004). For example, generally recognized benefits from increased physical activity are reduced risk of heart disease and stroke, reduced risk of obesity, reduced risk of osteoporosis and diabetes, enhanced mental health and quality of life (U.S. Department of Health and Human Services, 1996).

Legal enforcements of cyclists' right to use the road are important. In the United States, lawfully traveling cyclists are frequently told by drivers, or police officers, to move aside or get off the road (Pucher et al., 1999). Contrary to Europe, bicycling in the United States is mainly used for recreational purposes and is not associated with high standards of living. However, many European countries have over ten times higher percentage of bicycling than the U.S., despite high incomes. In many instances, the bike is the fastest and best way to get around. In the United States, the bike faces disadvantages such as low urban density, lack of bicycling culture, inexpensive automobile use, and low safety and speed for cyclists (Pucher et al., 1999).

It is common for Americans to claim that weather is an important factor as to why they do not bicycle. However, cold weather does not determine low bicycling rates. Northern Europe and Toronto, which is one of the coldest cities in North America, has higher rates of bicycling than any large U.S. city (Pucher et al., 1999). In Sweden, bicycling is even encouraged in

the wintertime by removing the snow on bike lanes and paths, before taking care of the roads.

The number of bicycle trips in the U.S. has doubled over the past two decades. However, 48% of trips by all modes in American cities are still shorter than three miles. Therefore, the potential for further growth in bicycling seems enormous (Pucher et al., 1999), under the assumption that drivers are willing to use this mode of transportation. It has been found that people often have negative feelings towards bicycling, and prefer walking over bicycling (Forward, 1999).

Even if biking does not seem to be the most popular alternative mode of transportation, it is an easy and beneficial way to improve alternatives. The results of a cost-benefit analysis of bicycling by Saelensminde (2004) showed that the benefits of investments in cycle networks are estimated to be at least four to five times the costs.

Urban form changes

Land use pattern is the most important determinant of automobile dependence (Kenworthy & Laube, 1999). Consequently, one of the most effective ways of reducing automobile use and retaining high shares of other modes of transportation seems to be controlling the structure of cities (Loukopoulos et al., 2004; Schwanen et al., 2004).

Europe has been prominent in terms of urban form changes and land use regulations. Examples of urban form changes are; automobile free pedestrian zones where cars are forced to be parked on the fringe of the city centre, traffic calming measures such as reduced speed limits, narrowing streets and discouraging through traffic (Pucher, 1995b). Examples of land use policies are; decreasing *urban sprawl*[7] by banning out of town shopping malls, promoting mixed land use [8], and concentrating residential development to certain nodes outside the cities with good public transportation (Luk, 2003; Schwanen et al., 2004).

Research shows that governmental intervention is essential for the viability of other travel modes and the quality of life in urban areas. American cities have auto dependent land use patterns, which decreases the viability of other modes of transportation since travel distances are too far (Kenworthy & Laube, 1999). In order for other modes to be feasible there is a need for more compact mixed land use, and a pedestrian and bike friendly built environment (Henderson, 2004). These land use policies are extra efficient if they are combined with economic policies that increase the real cost of both car ownership and use (Kenworthy & Laube, 1999). According to Pucher (1995b), the sort of laissez-faire approach to private car use and urban/suburban development that is common in the United States would be a disaster for European cities.

Parking is another important structural factor. It is not wise to keep on adjusting the parking capacity to the demand. This will only lead to increased traffic and inefficient land use. Employers usually offer their employees abundant parking, therefore restructure institutional factors like this is important. It has been concluded that automobile use will decrease, if the distance between parking and work place is increased. In addition to reducing the number of parking spaces and relocating them, financial incentives can also be used, such as higher parking fees or parking-cash-out offers. Free parking should be limited to rural areas (Priemus, 1995).

The disadvantage with this type of solution is that large changes in urban form might be necessary to produce small changes in car and transit usage (Luk, 2003). Restructuring cities is a costly and inflexible solution as well. Therefore, it is useful to compare these incentives effectiveness with other alternatives.

Comprehensive policy and target groups

Means of and possibilities to reduce automobile use, can not be studied without considering the whole context. They have to be part of a comprehensive transport and land use policy, and the combination of several strategies is more likely to be efficient (Priemus, 1995; Kostas & Basbas, 2004; De Vlieger et al., 2002; Steg & Tertoolen, 1999; Pucher, 1998; Loukopoulos et al., 2004). For example, if no alternative modes are available, it is not easy to reduce automobile use by different incentives (Kostas & Basbas, 2004). A simultaneous improvement of alternatives is also important in order to increase the acceptability of other policies (Pucher, 1998).

The implementation of a policy is usually expensive, therefore there is a need to identify different target groups, and target polices to where they can be most cost efficient (Mackett, 2003; Steg & Tertoolen, 1999; Bamberg & Schmidt, 2001).

It has become a general problem that households are increasingly car dependent, and use the car even for very short trips, without consideration of alternatives. Therefore, a common target group is to focus on trips less than five miles (Mackett, 2003). Considering the amount of time it takes to start up, park and walk in urban areas, the time by car does not differ much compared to other modes of transportation for a short trip. It has also been concluded that short

[7] *Urban sprawl* definition: "The physical pattern of low-density expansion of large urban areas under market conditions into the surrounding agricultural areas. Sprawl lies in advance of the principal lines of urban growth and implies little planning control of land subdivision. Development is patchy, scattered and strung out, with a tendency to discontinuity because it leap-frogs over some areas, leaving agricultural enclaves." (EEA, 2005)

[8] Allow mixed zoning of land, so residential and commercial areas can coincide.

trips disproportionately use more energy compared to long journeys (Black et al., 2001). Focusing on short trips is also a good financial investment, since alternatives such as walking and bicycling do not require large funds (Mackett, 2003).

Another common target group is school and work trips, which seem to be promising for reduction of automobile use. They are predictable, easy to plan, and usually consist of only one roundtrip. In the context of school trips, college students can be an interesting target group for several additional reasons, as will be discussed below.

Students

Students differ in some ways from the general population in regards to automobile use and automobile dependence. They are generally fit and healthy, do not have a lot of money, usually live close to campus, and do not have any children. Consequently, research shows that students usually drive less, and are more susceptible to different incentives (Pucher et al., 1999; Bamberg & Schmidt, 2003; Fujii & Kitamura, 2003). Students are also an important part of the trends that will be prevalent in the future, which adds to the benefits of studying and trying to influence this target group.

Alternative modes of transportation are more likely to be common among young people and college students. Cycling for instance, is likely to be popular for a number of reasons, such as low incomes, limited campus parking, predominance of short trips, and compatibility with cycling's casualness and sportiness (Pucher et al., 1999). In a study of students in Germany, 38.8% used a bike, 37.1% used public transport, 18.7% used a car, and 5.4% walked to campus (Bamberg & Schmidt, 2003).

Even if the general population is not especially susceptible to changes and improvements in other modes of transportation, studies of students prove otherwise. Bamberg & Smidth (2001) and Fujii & Kitamura (2003) tested how a free bus ticket would influence the travel mode choice of students in Germany and Japan, and this intervention caused a drastic decrease in the students' car use. The most interesting finding from Fujii & Kitamura (2003) was that even a temporary free bus ticket, could permanently change automotive travel to public transportation.

According to a British study, the most important reason for driving among young people is convenience (Mackett, 2003), so this does not differ from the general population. However, social norms are especially important among young people, who need the car in order to belong, develop social networks, go out, and be independent from their parents (Carrabine & Longhurst, 2002; Forward, 1999). Regarding morality, students seem less prone to look at automobile use from a moral perspective, compared to the rest of the population (Bamberg & Schmidt, 2003). Previous research concerning students and automobile use has taken place in Europe, therefore, investigating the attitudes of American students is important.

The United States

The development of automobile use has been different in the United States compared to Europe. The Unites States is the most automobile dependent country in the world. It even has a 70% higher automobile use than its closest followers Australia and Canada (Kenworthy & Laube, 1999). European and Asian countries are much more transit oriented, with higher levels of walking and cycling. For the past five decades, public transport has been considerably more important in Europe than in the United States. Public transport accounts for 23 percent of total urban travel in European countries, while it only accounts for 3 percent in the United States. The cause of this difference is not due to wealth or vehicle ownership, but mainly due to land use patterns and policies (Kenworthy & Laube, 1999).

Urban sprawl has been prevalent in the United States, and made other modes of transportation more complicated (Kenworthy & Laube, 1999). Suburbanization has been common in Europe as well, but the density of European suburbs is at least four times greater (Newman & Kenworthy, 1992). Europe has been extensively controlled by governmental regulation of land use, public transportation, and the cost of vehicle ownership and use. However, the situation in the U.S. is just as much a result of governmental policies. Public transportation used to dominate urban travel in the United States, and today public transportation is not even considered by most Americans. The public sector has played an important role in this, by favoring private car use and roadway construction through subsidies, artificially low prices, tax advantages, investments in suburban infrastructure and marginal control of land use. Simultaneously, public transportation has been neglected, and the negative effects of automobile use have been ignored. Due to these differences in policy, public transportation faces an unfair competitive disadvantage in the U.S., and consequently the price of public transportation relative to the cost of automobile use, is considerably lower in Europe. The combination of compact land use pattern, high taxes on automobile use, and subsidies on public transportation makes other modes a realistic alternative in European countries. For many Americans the only option, other than using the car, is immobility (Pucher, 1995b)[9].

[9] To read more about the differences between the United States and Europe see Pucher (1995a,b) and Kenworthy & Laube (1999).

Henderson (2004) stresses the importance of asking: Who is entitled to decide which types of mobility that is important and to whom it is available? It is a matter of values and equality since children, elderly, handicapped and poor often are neglected in automobile dependent countries.

The automobile dependency in the United States is a result, and a drawback, of a free market economy. A free market economy is governed by a high mobility of humans, financial resources, and the ability to cover large areas in a short amount of time. On average, Americans travel twice as far as Europeans, but spend only a few more minutes per day traveling (Guiliano & Narayan, 2003). However, if it goes too far, not even free market economy benefits from this system anymore. Henderson (2004) describes how Atlanta, Georgia, had to go through a groundbreaking shift to other modes of transportation, because it was crucial in order for businesses to survive in that region. Kenworthy & Laube (1999) supports this by concluding that there are no obvious gains in economic performance from developing auto dependence in cities. The transport systems in European and wealthy Asian cities appear to be both most economically cost effective and most *sustainable*[10].

In the United States, there has been a rapid growth in ownership of so called Sports Utility Vehicles (SUVs, Fig. 2). SUV registrations in the States increased by 56 percent between 1997 and 2002, and in Indiana it increased by 103 percent during the same period of time (Census, 2005). These types of vehicles are generally disliked by environmentalist, since they commonly waste energy and pollute more than economy or midsize vehicles (Plaut, 2004). According to the Environmental Defense (2005), the typical SUV today has a fuel efficiency that is 29 percent lower than that of the average car, resulting in about 40 percent higher CO_2 emissions. Diekstra & Kroon (2004) concludes that this type of vehicle with four wheel drive should be severely limited, since they are rarely used for their original function as off-road vehicles. On the other hand, Plaut (2004) argues that raising vehicle taxes for SUV's might not be a fair policy, since SUV owners are more likely to live in the countryside and thereby do not contribute to the air pollution in the cities. In addition, they usually have fewer vehicles. Considering how debated this issue is, it is interesting to see how many are actually interested in having a SUV, and which incentives that could make them choose another option. Incentives that have been proposed are increasing insurance rates and registration fees for SUV's and providing information about roll over safety.

[10] *Sustainable* definition: "Use of the environment and its living resources at a rate that does not exceed its capacity for renewal, in order to ensure its availability for future generations" (EEA, 2005).

Figure 2. Sports Utility Vehicle (Auto Sohu, 2005).

Religion

In addition to factors such as time, money, and nature, religion is a universal "trump card" when it comes to motivating people and providing effective arguments (Douglas, 1970; Anderson & Leal, 2001). Therefore, it is interesting to investigate religion in the context of providing arguments for automobile use reduction.

To date, religion is seldom used in environmental debates. On the other hand, politics in the United States is infused with religious arguments and reasoning, since faith and God have always been integral parts of U.S. history. In general, faith is an everyday part of the American culture, in contrast to many European countries (Norris & Inglehart, 2004). Therefore, religion might have a place in the context of American automobile use. According to an American study by Orr (2003), a religious perspective may appeal to people of faith, and can be used to address global environmental problems.

During the past decades, there has been a rise of ecumenical religious movements that focus on environmental issues. Some of the organizations in the United States are: The Regeneration Project (2005), Faith in Place (2005), Eco-Justice (2005), Earth Ministry (2005), Creation Care (2005), and What Would Jesus Drive (2005). These organizations emphasize one's responsibility and stewardship of creation, and stress that caring about environmental issues and the related justice issues is an important part of God's plan for those on earth. In California, the Regeneration Project has successfully played an active role in encouraging religious leaders to speak to their congregations about these issues, especially prior to the passing of new environmental laws and regulations (Bingham, 2005).

Even if previous research has found religion to be a weak predictor of environmentalism in the United States (Hartwig Boyd, 1999), it is interesting to see if

religious arguments can be used to reduce automobile use. The state of Indiana is relatively conservative and near the "Bible belt" (Appendix, 1), therefore religion is a possible way for leaders to reach people when dealing with environmental issues.

Demographic factors

Demographic factors that seem to influence automobile use to some extent are gender, education, age, and income. Previous studies have found that individuals with a strong environmental commitment are more likely to be female, highly educated, younger than 30, and have an income higher than average (Golob & Hensher, 1998; Zelezny et al., 2000; Ewert & Prskawets, 2002).

Men are more likely to be car drivers than women, because their trips to work are usually longer (Mackett, 2003; Guiliano & Narayan, 2003). However, there is no difference between the genders in total number of daily trips. In terms of choosing alternative modes of transportation, women appear to be more likely than men to choose public transport and trip chaining, whereas men are more likely than women to choose a motorcycle or moped (Gärling et al., 2000).

The average educational level strongly affects environmental behavior (Ewert & Prskawets, 2002), and is most likely connected to general problem awareness and knowledge about specific environmental problems (Nordlund & Garvill, 2003). Therefore, it might be beneficial for universities to educate their students about environmental problems.

The effect of income on automobile use is unclear. Income seems to have an effect on vehicle ownership but not necessarily on use. Since the American market is saturated when it comes to vehicle ownership (Dargay & Gately, 1999), income does not have a high influence on ownership anymore. Jakobsson et al. (2002) concluded in a Swedish study that income did not have any significant effect on how people reacted to economic disincentives, while according to their studies of the U.S., Great Britain, and Australia Guiliano & Narayan (2003) and Luk (2003) found that the effectiveness of economic incentives decline with increased income. At least several sources seem to confirm the fact that the value of time increases with increased income (Priemus, 1995; Guiliano & Narayan, 2003), and so does distance traveled (Guiliano & Narayan, 2003). In general, land use patterns and income are equally important when it comes to travel decisions, but for Americans, density seems to have more influence than income (Guiliano & Narayan, 2003). However, in the context of students, income may be more influential, especially if they are supporting themselves financially as compared to students supported by their parents.

Purdue University

The research in this study was performed at Purdue University, West Lafayette, Indiana. At the time of the study, Purdue University had roughly 38,600 registered students and 14,600 faculty and staff. The University facilities and buildings are concentrated on a campus, with 64 percent of the students living off campus (Data Digest, 2005). The University is situated in West Lafayette, a small university town in Tippecanoe County, Indiana, with approximately 28,800 permanent residents (City of West Lafayette, 2005).

Purdue University has struggled with traffic issues on campus, and has created a "campus master plan", with a long term objective to minimize on-campus traffic and relocate the majority of the roads and parking lots to the perimeter of campus (Collier, 2005). Parking permits are only provided for people living more than one and a half miles from campus, and the price of parking permits will almost double between 2004 and 2007[11]. However, the number of parking spaces will remain the same, even though some of them will be moved to remote locations (Kemper, 2005). In order to increase the number of people using the bus, Purdue University subsidizes the local bus company, City Bus. Starting in 1998, busses have been free for Purdue affiliates and the number of passenger boarding's per day, has increased from 4,000 to 27,000 (Metzinger, 2005). Despite this increase, a survey performed by City Bus (2003), concluded that there is still growth potential, because only eight percent of Purdue employees, and 21 percent of the students ride the bus. City Bus has also tried to increase the possibility for multimodality, by providing bicycle racks on the majority of their busses (Metzinger, 2005).

Two main concerns for Purdue University are safety and land use. It is important to increase the safety on campus, as many students have to cross streets with heavy traffic in order to get to class. In 2004, 337 traffic accidents occurred on Purdue campus[12], and twenty-five resulted in personal injury (Purdue Police Department, 2005). Regarding land use, it has been important to use valuable land on campus for expanding the University's educational facilities. Surface parking is an inefficient and expensive use of land, and construction of parking garages is costly. Moreover, it has been a priority to improve the aesthetics of campus, and parking lots have been converted into parks (Fig. 3, 4 and 5) (Collier, 2005).

[11] A-permits will increase from $150 to $250, and B/C-permits will increase from $60 to $100 per year.

[12] The statistics does not include accidents occurring on streets adjacent to campus, since they are part of West Lafayette Police Department.

Air pollution has not been one of the University's concerns. However, Indiana is one of the states that fail to meet the Environmental Protection Agency's national air quality standards (EPA, 2005b). According to the Environmental Defense (2005), Tippecanoe County is among the 10% most polluted counties in the United States, and on average 50% of the pollutants in the Midwest region are caused by motor vehicles (American Lung Association, 2005). A large number of students are frequently exercising on campus, especially in proximity to the State Street, SR 26, that runs directly through Campus and carries heavy traffic. As mentioned earlier, it is not healthy to exercise close to traffic. So far, this problem has not been acknowledged, but improved air quality on campus would be a positive bi-product from the "campus master plan".

The city of West Lafayette is committed to improving biking facilities and is continuously constructing new trails in the city. The twelve miles of trail that has been created so far, has received positive feedback from the community. Moreover, the trails are frequently utilized (Mills, 2005). However, they are mostly used for recreational purposes, and are difficult to use for transportation within the city. Most of the bicycling still has to take place on narrow sidewalks and on roads without bike lanes, which is not beneficial, as mentioned above.

Aim

The current automobile dependence in the United States is unsustainable. Therefore, automobile use needs to be reduced. In order to do so in an efficient way:

- The aim of this study was to identify useful automobile reducing incentives, arguments, policies and alternatives, through survey research in the United States.

The following sub issues were also considered:

- Is there any public support for automobile use reduction and alternative modes of transportation in the U.S.?
- Is there a difference between Europe and the United States on the effectiveness of different incentives?
- Can religion be used as an argument to make Americans drive less?

Figure 3. Purdue Memorial Mall, with roundabout and parking lots, 1986 (Collier, 2005).

Figure 4. Purdue Memorial Mall, with park and fountain, 1998 (Collier, 2005).

Figure 5. Purdue Memorial Mall today. Students are relaxing where it used to be a roundabout. (Purdue, 2005).

MATERIALS & METHODS

Sample and procedure

The sample for the study consisted of students, living off campus and having a car. The number of subjects was 411 and corresponded to 1.06% of all registered university students, and 1.66% of the students living off campus. The reason for choosing students living off-campus with cars was to include respondents that had an actual choice between different modes of transport for daily trips to campus.

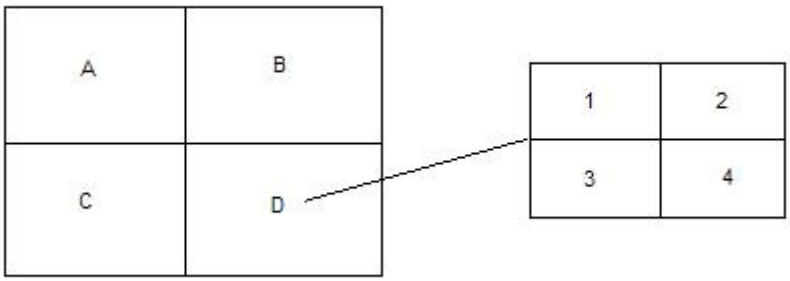

Figure 6. Area probability sampling. A public area is divided into different geographical units (A, B, C, D) and different dwelling areas (1,2,3,4) within these units. These areas are randomly drawn and visited during different times of the day.

This living situation is also the one that best represents the public. In West Lafayette, where the Purdue campus is located, public transportation, bicycles, and even walking, can be realistic options for the majority of the students.

A survey was distributed face to face using *area probability sampling* (Fig. 6). Accordingly, the Purdue campus was divided into different geographical units and different dwelling areas within these units. These units and areas were randomly drawn and visited during different times of the day for three weeks (Dillman, 1978; Sudman, 1976). Every other student within these units was approached and asked if they lived off campus, had a car, and wanted to complete the survey. The sampling continued until a sample of at least 400 respondents was achieved, so the conclusions could be established with an accuracy of 95% (sampling error 5%). The reason for choosing this method of sampling was lack of resources to conduct a mail or telephone survey.

Out of the students approached, a little bit less than 50 percent were not eligible, since they lived on campus or did not have an automobile. Out of the eligible students, 41 did not have time, or did not want to answer the survey, and six surveys were never returned.

The result was 411 respondents, and a response rate[13] of 90 percent. Out of these, ten surveys were not fully completed, but the answers obtained were still incorporated. The gender distribution (52% men and 48% women) was slightly fewer men, and more women, than on Purdue campus in general (59% men and 41% women).

There was a good distribution of different student levels, but freshmen and graduate students were underrepresented compared to Purdue University in general (Tab. 1). The most likely reason for this was that many freshmen live on campus, and most graduate students spend the majority of their time in their offices.

The median living distance from campus was 2.25 miles, and the median age was 22 years. Finally, over 150 different majors, and all academic programs was represented. The distribution between the different academic programs is displayed in figure 7.

Table 1. Representation of student levels (Data digest, 2005)

Student level	Sample (%)	Purdue (%)
Freshmen	5.8	20.7
Sophomores	23.6	20.4
Juniors	31.0	19.4
Seniors	27.8	21.0
Graduate students	11.8	18.5

[13] Response rate = response/(non response + response)

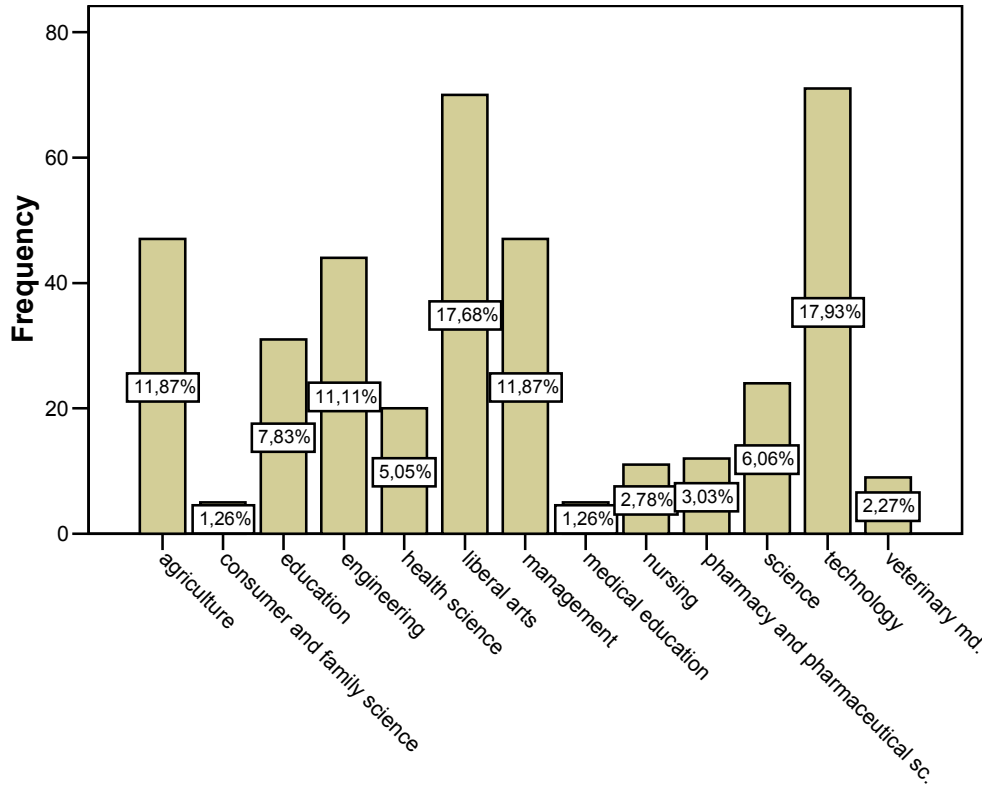

Figure 7. Representation of academic programs.

Survey

The survey was designed using "the Total Design Method" by Don Dillman (1978), and was composed of several parts. Each part was preceded by a short text explaining the subsequent questions. The questions asked were selected using the research and studies reviewed in the background study. The complete questionnaire can be reviewed in appendix 3.

First, the respondents were asked some general questions about their travel behavior, such as how and why they drive. This was followed by questions about their attitudes toward driving and environmental problems. Consistently throughout the survey, there was either a "don't know" or an "other" option in the questions. If the respondents were asked to rate their opinion about something, this was always done on a four point scale (Parker, 2005). A common method in survey design is to have a five point scale, but according to Sudman & Bradburn (1989), few people are truly neutral and in the middle. If people are leaning on the issue, it can be very helpful to exclude the middle point, and doing so will not change the outcome of the results (Presser & Schuman, 1980).

The next section was related to different incentives and policies. The students were asked to rate alternative modes of transportation that they were likely to use, and incentives or arguments that could make them choose another form of transportation. Since a drastic change is often necessary to make people reconsider their automobile use, most incentives presented in the survey were drastic, such as closing off campus to automobile use, a doubling of gasoline prices, or fast, inexpensive, and frequent public transportation. The arguments presented varied from being locally connected to Indiana and everyday life, to being more general and global issues. Some examples are health and farming issues versus justice and biodiversity issues. Questions about religion as a possible argument were also asked, followed by questions about which incentives that would make the students decide to buy a car instead of a SUV.

Subsequently, there was a section with brief, mostly yes/no questions. The majority of these questions were related to interest in different incentives, such as pay-as-you-drive insurance, tele-working, improved public transportation, parking-cash-out options, and so on. Finally, some general demographics were asked such as gender, number of children, number of roommates, citizenship, size of city/town for upbringing, student level, financial support, area of study, and year of birth.

Evaluation of data

In order to investigate the results from the survey, a statistical analysis of the data from the respondents was performed with the software SPSS 12.0.

To determine whether the outcomes were significant or merely within the range of experimental scatter, a standard *Chi-Square* was used to analyze associations between different questions. The results are reported as *Chi* (x^2) and *P* in the results section. The value of x^2 and P reports the chance of error and shows if the correlation is significant or not. The P-value is reported at three different levels, <0.05, <0.01 and <0.001. A P-value of less than 0.05 indicates that the difference between groups is statistically significant with less than a 5% chance of error. The lower the P-value and the higher the Chi-x^2-value, the less likely the association between the different variables is due to random variation or chance. Only significant results are reported in the results section.

To be able to perform a standard Chi-square analysis, there must be at least five observations within each group that is compared. Consequently, if the count was less than five in some groups, these were either bulked into larger groups or excluded. Throughout the cross analysis, the "don't know" answers were excluded as missing data. Unanswered questions or questions answered unintelligibly (e.g. circled two answers) were also excluded from the study (Parker, 2005).

With the purpose of rating answers previously ranked by the respondents *Friedman's* and *Kendall's W test* were used. The Kendall's W test calculates a coefficient of agreement among raters, and can therefore be used to rate the popularity of different options that have previously been ranked by the respondents. Kendall's W, coefficient of concordance test gives the same numerical answers as Friedman's test of two-way analysis of variance.

RESULTS & DISCUSSION

How and why people drive

The most common modes of transportation to campus were driving and walking. The majority (58%) of the students drove to campus, 23% walked, 16% took the bus, and 2.7% rode bikes (Fig. 8). This differs from a German study, where 38.8% of the students rode their bikes, 37.1% used public transportation, 18.7% used a car, and 5.4% walked (Bamberg & Schmidt, 2003). Walking was more common than biking among American students, which correlates with the findings that people usually have negative feelings towards cycling, compared to walking (Forward, 1999). Even if the share of driving was high compared to European students, in relation to the country as a whole, Purdue University had high shares of alternative modes of transportation (Kenworthy & Laube, 1999).

Most of the students frequently used cars, even for short trips. Students who lived one mile or less from campus were most likely to walk, but for all other distances, a car was the primary mode of transportation. Bus transportation was common for people who lived up to five miles from campus, while biking only was common for people who lived one mile or less from campus.

Figure 9 presents the students' living distances from campus. The percentages of driving to campus were high, even for students who lived close. Out of the students in the sample, 63.5% lived within three miles of campus, and 45.5% of the students who drove to school lived within this distance. Out of the people who lived within one mile from campus, 11.2% drove, and 65.4% of the people who lived 1-2 miles from campus drove, furthermore 75.9% of the people who lived 2-3 miles from campus drove. All these distances are realistic for other modes of transportation, such as walking, biking, and public transportation.

When looking at driving distances in general, 61.1% of the students said that the majority of their driving trips were more than three miles, and 36.3% said that the majority of their driving trips were shorter than three miles. According to Pucher et al. (1999), 48% of trips by <u>all</u> modes in American cities are shorter than three miles (Pucher et al., 1999). The car was not only used by the students for short trips, it was also used frequently. Out of the students surveyed, 53% used their automobile several times every day, and 19% used it 5-7 times a week.

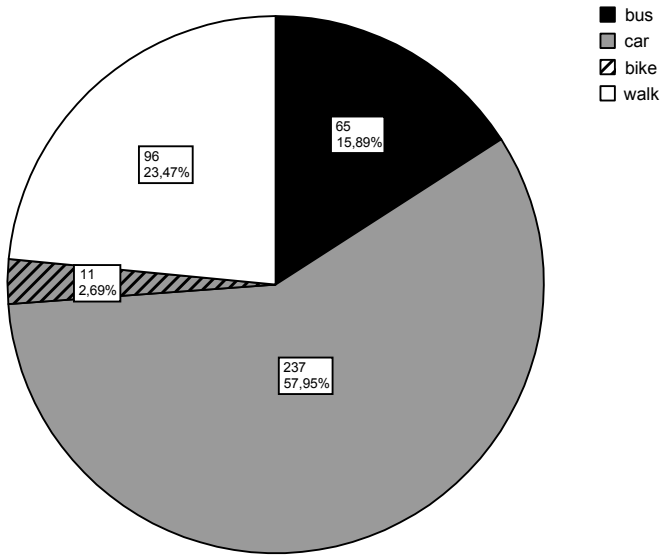

Figure 8. Primary mode of transportation to campus.
The category "other" consist of one observation, equal to 0.24%.

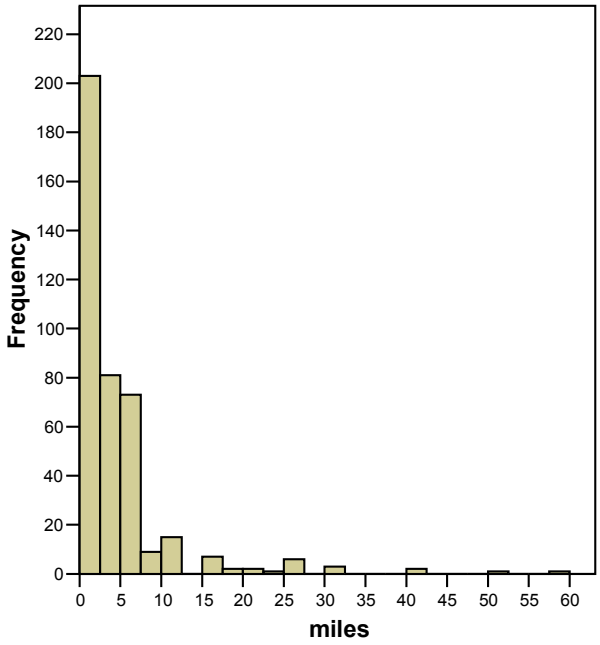

Figure 9. Frequency of living distances from campus. (Mean= 4.3, Mode=1.0, Std.Dev.=6.6).

The main reasons to why the students drove were: (1) convenience, (2) distance, (3) faster, save time, (4) weather, (5) easier, no waiting, (6) its my only option, and (7) freedom, independence (Tab. 2). All the main reasons that were mentioned by the American students correlated well with previous research, despite the fact that Swedish, Dutch, and British households were the focus of those studies (e.g. Hagman, 2003; Priemus, 1995; Gärling et al., 2002; Jakobsson et al., 2002; Mackett, 2003; Priemus, 1995). The result that convenience was ranked the highest is supported by Mackett (2003) who claimed that young people are most likely to use their cars for the sake of convenience.

Some differences between Europe and the United States were that the Americans more frequently said that driving was their only option, while in a Swedish study many respondents mentioned that they already had reduced their automobile use as much as they possibly could (Jakobsson et al., 2002).

Attitudes about driving and environmental problems

Many of the students did not worry about any problems related to automobile use, but among the issues of concern, air pollution, and gasoline prices were most common. The majority of the students had some type of concern regarding automobile use (60.0%), however 40.2% did not worry about any problems at all caused by automobiles. Out of the students with concerns, 31.2% had concerns that were not related to environmental issues, and 28.5% had environmental concerns (Fig. 10). The main problems caused by automobile use that worried the students were: (1) air pollution, (2) gas prices, (3) accidents, (4) hard to find parking, (5) overall cost, (6) environmental issues, and (7) impaired drivers (Tab. 3). All these reasons are consistent with Swedish and Dutch studies. In general, health issues (exercise) and environmental issues were most important in those studies (Hagman, 2003; Tertoolen & Verstraten, 1995).

People with no concerns, or non-environmental concerns, were less likely to change their habits due to any policy, and people with environmental concerns were more likely to change (x^2=31.9, P<0.001) (Fig. 11). People with environmental concerns also found it more important to reduce automobile use (x^2=93.5, P<0.001). These results are consistent with the fact that people with problem awareness and ecocentric values are more likely to be willing to cooperate and change to more environmental behaviors (Steg et al., 2001).

Table 2. Ranking of main reasons for driving. Open ended question. The percentages add up to more than 100 percent, since the respondents could write more than one answer

Factor	Count	%
convenience	124	30.2
distance	115	28.0
save time, faster	103	25.1
weather	47	11.4
easier, no waiting	37	9.0
its my only option (no bike lanes/bus)	27	6.6
freedom/independence/flexibility	22	5.4
fuel consumption/good gas mileage	19	4.6
time of the day	16	3.9
poor bus schedule	16	3.9
price	16	3.9
fun to drive	13	3.2
schedule of day	12	2.9
need to carry things	12	2.9
reliability	11	2.7
aesthetics of car/performance	10	2.4
I don't like the bus	7	1.7
safety	7	1.7
accessible	7	1.7
laziness	7	1.7
other	29	7.1

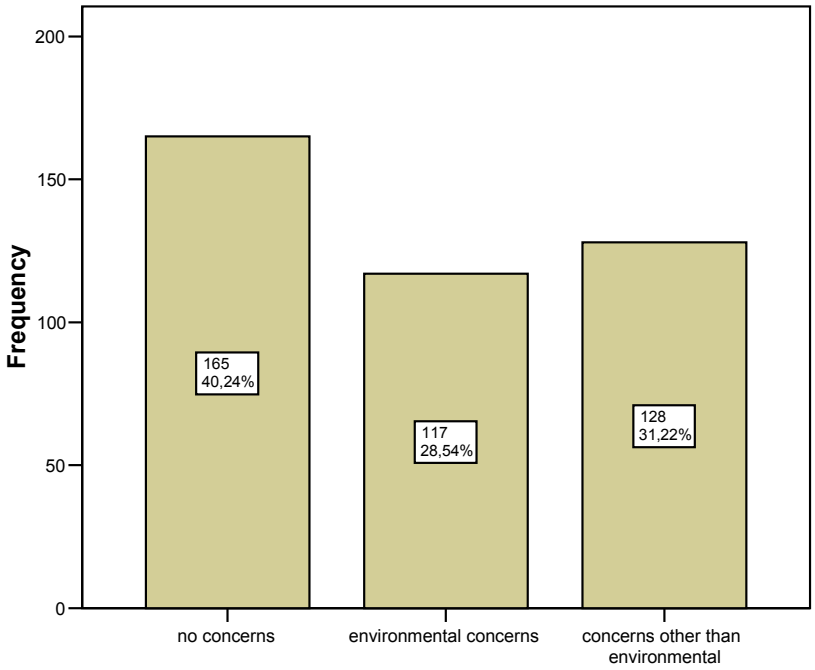

Figure 10. Students' type of concerns regarding problems caused by automobile use.

Table 3. Ranking of main concerns related to automobile use. Open ended question. The percentages add up to more than 100 percent, since the respondents could write more than one answer

Factor	Count	%
air pollution	98	23.8
the cost of gas	56	13.6
accidents	38	9.2
hard to find parking	30	7.3
over all cost	19	4.6
environmental issues	16	3.9
poor drivers/drunk driving	14	3.4
car breakdown	12	2.9
oil dependency/war/oil depletion/oil spills	11	2.7
traffic/congestion	10	2.4
Gas guzzling vehicles/fuel consumption	9	2.2
depletion of natural resources	9	2.2
parking tickets	6	1.5
jay walkers	5	1.2
not enough exercise/obesity	5	1.2
reduction of fossil fuels	4	1.0
global warming/climate change	4	1.0
other	16	3.9

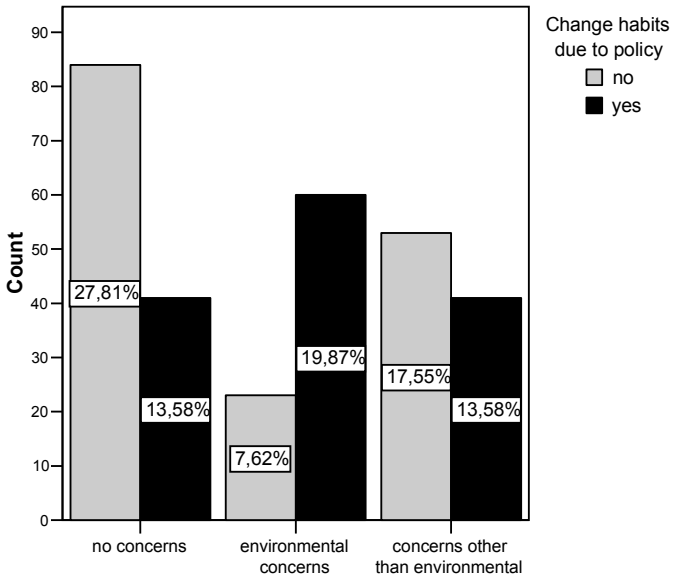

Figure 11. Likelihood of changing driving habits due to a policy, in relation to type of concerns about automobile use.

Out of the students surveyed, 57% thought that it is important to reduce automobile use, and 39% found it unimportant. The most frequent answer was that it is somewhat important. The support for reducing automobile use seems to be lower than in Europe, where almost all respondents in a Swedish study agreed that it is important to reduce automobile use (Hagman, 2003). Several of the American students commented that they found it important to reduce emissions, but not automobile use. Consequently, they wanted to solve the problems with technology such as hybrid cars.

The majority of the students (66%) agreed that global warming is a human induced problem, and 29% disagreed. Several students mentioned that automobile use is not the main cause of global warming, and that industries are the most important factor. This indicates problem awareness and knowledge, since automobiles account for one third of the CO_2 emissions (Whitelegg, 1997; Environmental Defense, 2005). However, it could also be a result of cognitive dissonance (p. 11), which often leads to defensiveness and a desire to point out that others are more responsible for the problem than one self (Tertoolen & Verstraten, 1995).

One fifth of the students (23.1%) said that they were willing to give up their car if problems with air pollution got worse, 49.1% said that they were not willing to give up their car, and 27.8% said that they did not know.

People who did not have any concerns about automobile use, or concerns that were not environmentally related, were less likely to give up their car because of air pollution (x^2=49.1, P<0.001). The negative answer probably dominates due to the fact that the students were asked to give something up.

As much as 76% of the students agreed that driving is a basic right which is an important part of American freedom, and should not be restrained by any policies, 21% disagreed (Fig. 12). This can be, and was, negatively related to public acceptance of policies (Gärling et al., 2002; Tertoolen & Verstraten, 1995).

Incentives and policies

The results showed that it is possible to change the students' habits with different policies and incentives. Out of the students, 39.5% said that they were not likely to change their driving habits due to any policy, and 35.1% said that they were likely to. A group of 25.4% said that they did not know, since it depends on the type of policy. Students who believed that automobile use is a basic right were less likely to change their habits (x^2=23.0, P<0.001), which confirms that individualists who have a strong belief in personal freedom, and see automobile use as a right, may dislike reducing car use more than others (Gärling et al., 2002).

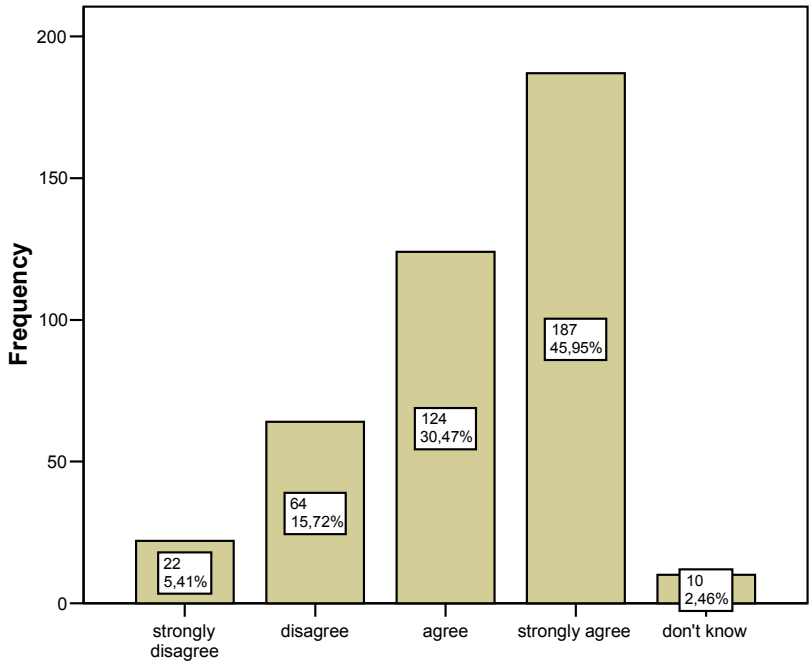

Figure 12. Number of students disagreeing or agreeing with the statement that driving is a basic right and an important part of American freedom, which should not be restrained by any policies.

People who rode the bus to school, were more likely to change their habits and people who drove to school were less likely to change (x^2=9.7, P<0.01). People who drove frequently were also less likely to change (x^2=15.8, P=0.001). This is consistent with the fact that mode choice influence attitudes (Golob & Hensher, 1998; Steg, 1996). On the other hand, people who rode the bus were not more inclined to have environmental concerns, or think that it is important to reduce automobile use. Unexpectedly, people who drove frequently thought that it is important to reduce automobile use (x^2=9.0, P<0.05), even if they did not have more concerns about the environment. Students who agreed that global warming is a problem (x^2=12.7, P<0.001), or had environmental concerns (x^2=31.9, P<0.001) were also more likely to change their habits due to a policy.

Alternative modes of transportation

The potential for automobile use reduction seems to be great since 56.7% of the respondents said that they were likely to use another mode of transportation. One third of the students (32.7%) said that they were not likely to use anything but their automobile, and 10.6% did not know. This supports the conclusion by Gärling et al. (2000) that people do not seem to express strong aversion against substituting the car by other modes.

However, some students said that they were likely to use another mode of transportation, but not likely to change their driving habits due to any policy. The reason for this could be that a mixed use of modes was already implemented, and the car was only used when necessary. It could also be a result of a positive versus a negative framing of the question. It was easier and more positive to say that they were likely to do something new – use another mode of transportation, compared to saying that they were willing to give up or change what they were already doing – their habits.

The alternative modes of transportation that the students were most likely to use were: (1) car pooling and public transportation, (2) trip chaining and walking, and (3) biking (Fig. 13). These results are consistent with previous research in Great Britain and Sweden (Mackett, 2003 & Gärling et al., 2000).

If the students were going on a longer trip[14], the incentives that were most likely to make them choose another mode of transportation were: (1) improved public transportation, (2) a higher gas price, (3) car pool lanes and expensive and limited parking, (4) limited access, and (5) highway tolls (Fig. 14).

[14] This was exemplified as a trip to Chicago, which is about 120 miles from West Lafayette.

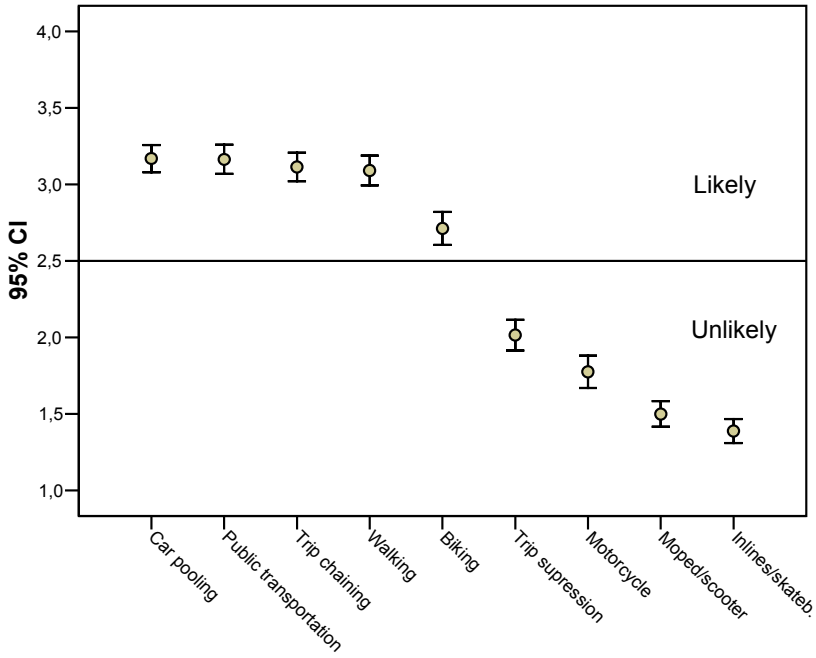

Figure 13. Alternative modes most likely to be used. 1 is very unlikely and 4 is very likely. The error bars are showing the mean of the respondents' answers with a confidence interval of 95%.

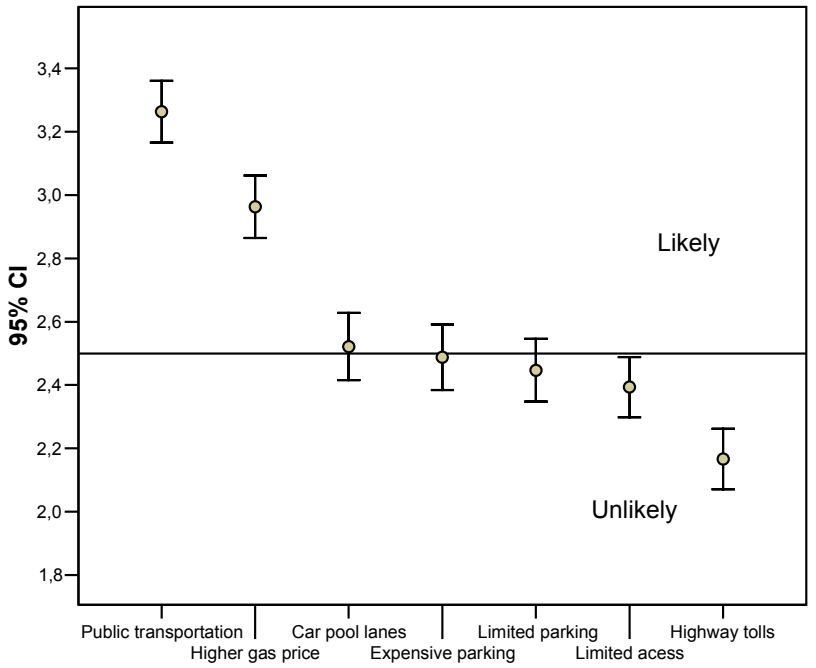

Figure 14. Incentives most likely to achieve a switch to another mode of transportation on a long trip. 1 is very unlikely and 4 is very likely. The error bars are showing the mean of the respondents' answers with a confidence interval of 95%.

This is consistent with the fact that a drastic increase of fuel price is likely to be effective (Priemus, 1995), that road pricing usually is ineffective (Jakobsson et al., 2000), and that improving public transport is the specific action which drivers say is most likely to attract them out of their cars (Mackett, 2003). Even if improvements in public transportation are not as effective as it seems, students appear to be a receptive population (Fujii & Kitamura, 2003).

If the students were going on a shorter trip[15], the incentives that were most likely to make them choose another mode of transportation were: (1) a closed off campus, (2) improved public transportation, (3) expensive parking, (4) a higher gas price, road tolls, and limited parking, (5) limited access, and (6) more bike lanes/paths (Fig. 15). Closing off campus was the most coercive policy, and it was ranked as the most effective one. This is consistent with previous research showing that coercive policies are more effective (Gärling et al., 2002; Loukopoulos et al., 2004).

A higher gas price was less important for a short trip compared to a long trip, probably due to the fact that the price difference will be less noticeable on a short trip. However, the relative gas consumption is higher for shorter compared to longer trips (Black et al., 2001), so in the end all the small, but frequent, expenses of short trips can add up to considerable amounts of money. This is consistent with the fact that people do not take the true costs of automobile use into consideration (Romilly, 2001). Expensive parking was more important for a shorter trip, most likely due to the fact that the payment is expected to occur more frequently.

Biking ranked high as an alternative mode of transportation, despite this, few students said that improved bike lanes, and paths were likely to make them refrain from using the car. However, in the open ended questions 1.5% of the students spontaneously mentioned that they would drive less if safety was improved for pedestrians and bikers. This is related to the fact that traffic prevents people from bicycling or walking as much as they would otherwise, and that people need to feel safe in order to use softer modes of transportation. Nevertheless, since Americans are not as used to having the option of riding bikes or walking, it is reasonable that they do not express or have a great wish to do so.

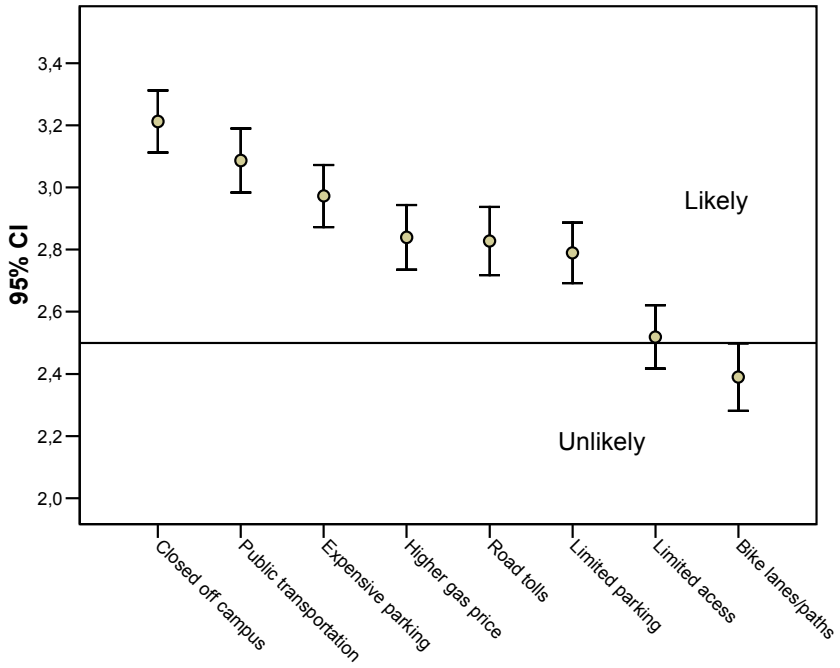

Figure 15. Incentives most likely to achieve a switch to another mode of transportation on a short trip. 1 is very unlikely and 4 is very likely. The error bars are showing the mean of the respondents' answers with a confidence interval of 95%.

[15] This was exemplified as a trip around town or to campus. Usually a short trip is defined as a trip of less than three or five miles.

Incentives that can reduce driving

The main factors that could reduce automobile use were: (1) gas prices and overall cost, (2) more convenient public transportation, (3) no convenient or expensive parking, (4) shorter distances/living closer, (5) nothing, (6) car repairs, and (7) nice (or bad) weather (Tab. 4). All these reasons, besides nothing, are supported by previous research (e.g. Mackett, 2003).

Table 4. Ranking of incentives most likely to reduce automobile use. Open ended question. The percentages add up to more than 100 percent, since the respondents could write more than one answer

Factor	Count	%
gas prices	158	38.4
more convenient public transportation*	67	16.3
no convenient parking	58	14.1
short distance/lived closer	48	11.7
nothing	47	11.4
car repairs	29	7.1
nice weather/bad weather	24	5.8
congestion/ a lot of traffic/ road condition	13	3.2
overall cost	10	2.4
low on gas	9	2.2
convenient car pooling	9	2.2
availability of convenient alternatives	8	1.9
poor gas mileage	8	1.9
pollution/environmental concerns	8	1.9
a faster way	7	1.7
If I had more time	7	1.7
more safety for pedestrians and bikelanes	6	1.5
parking tickets	5	1.2
intoxication	4	1.0
inconvenience/not practical to have car	4	1.0
closer supermarkets	4	1.0
need to exercise	3	0.7
other	21	5.1

*The students who answered that they wanted more convenient public transportation, often specified this as a need for more (1) frequent, (2) available, (3) reliable/timely, (4) closer bus stops, (5) and later bus times.

The environment (23rd place) and exercise (22nd place) ranked considerably lower compared to a Swedish study where the most important reasons were to save money and improve the environment, and the second most important reason was physical exercise (Jakobsson et al., 2002). Bad weather was frequently mentioned as a reason for not using alternative modes. It is impossible to improve the weather, but something that can be done is to provide more bus shelters (Mackett, 2003). In addition, weather can not be one of the main determinants of bicycling or bus use, since places like Canada and Northern Scandinavia have among the highest rates of bicycling and public transportation (Pucher et al., 1999).

When the students were asked to rank the first, second and third most likely reasons for choosing not to drive, the results according to Friedman's and Kendall's W test were: (1) save money, (2) stay fit/healthy, (3) save time, (4) and save the environment (x^2=335.5, P<0.001, W(a)=0.287). In a Dutch study, the same reasons were mentioned but time ranked number one and costs ranked number three (Tertoolen & Verstraten, 1995). The reason why money was ranked higher by the students is probably due to the students' lack of income. Research shows that the higher the income, the more preference will be displayed for faster forms of transport (Priemus, 1995).

When the students were asked to rank different statements and arguments that were likely to motivate them to reduce their automobile use, the results were as follows: (1) health (exercise), (2) national security, (3) air pollution (health), (4) biodiversity, religious responsibility, diseases, farming damage, and (5) justice (Fig. 16). This confirms the fact that problems closer to one's own body concerns people the most (Jacobs, 1999). National security is also easy to see as personal and close to home. However, local arguments in relation to global warming were not more effective than ones that were general. The fact that justice with the people in the third world ranked the lowest is consistent with the fact that it is not part of the own local environment (Machnaghten, 2003).

Religion was not an effective argument, at least not for students. An additional question was asked to study the relationship with religion, and 76.1% of the students said that an ecological sermon, explaining that pollution harms God's creation, would not influence how much they drive, and 7.5% said that it would. Students that would not be affected by an ecological sermon were also unlikely to be motivated by the argument above, stating that environmental protection is a part of one's religious responsibility (x^2=24.2, P<0.001). However, the students who were affected by the religious arguments did not necessarily answer consistently on both questions. The low effectiveness of religion as an argument is consistent with previous research (Hartwig Boyd, 1999) and the fact that students seem less prone to look at automobile use from a moral perspective (Bamberg & Schmidt, 2003). On the other hand, this study did not differentiate people who regularly attend church and people who do not. Therefore, this type of argument might be more effective in the context of people who frequently attend church (Bingham, 2005).

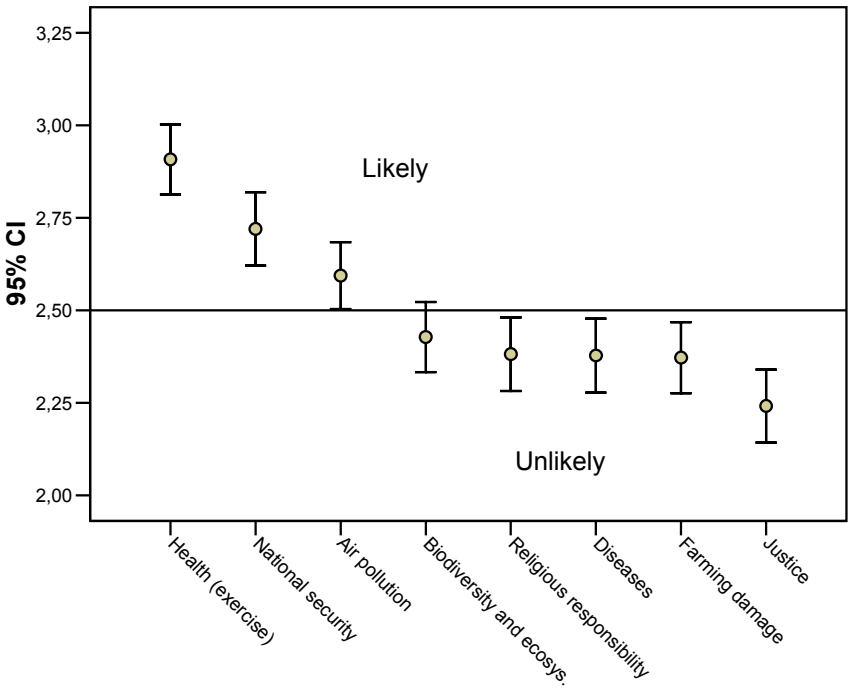

Figure 16. Different arguments likelihood of achieving a reduction in automobile use. 1 is very unlikely and 4 is very likely. The error bars are showing the mean of the respondents' answers with a confidence interval of 95%.

A majority of the students showed an interest for the new incentives that are available on the market today. As many as 67.7% were interested in pay-as-you-drive insurance, 78.5% were interested in tele-working, and 71.5% of the students would accept parking-cash-out offers. Some people mentioned that they could not tele-work because of the type of job they had and a few of the students mentioned that an offer of decreased tuition would be a good incentive to make them refrain from driving to campus. However, 84.2% of the students said that they would not give up their car if the registration fees were twice as expensive. Consequently, registration fees were not as efficient, potentially because fixed costs are usually not taken into account. Variable costs are more likely to be efficient (Romilly, 2001). A second possible reason is that doubling the registration fees was not enough (Priemus, 1995). Finally, a third reason might be that increasing registration fees is a negative incentive, while the others are more positive since they ask a person to accept an offer that might save them money, instead of giving up their car.

When asking the students two different questions about if different incentives would make them want to move closer to campus, there was almost a 50-50 split on the questions, with no difference between the two incentives.

Half of the students, 48.3% [46.0 %], said that they would not move closer to campus if driving was more "expensive", and 41.6% [42.5%] said that they would, the rest did not know. Furthermore, 42.9% [43.7%] of the students said that they would not move closer to campus if driving was more "complicated", and 42.7% [40.5%] said that they would, the rest did not know. Many of these students already lived within two miles of campus, and if these cases are excluded from the analysis, the results within the brackets are achieved. The results between the different incentives "expensive" and "complicated" do not differ much, the main difference was that there was a higher rate of "don't knows" for the second option, most likely because it is harder to picture what complicated means compared to expensive. The results show that it is likely that the students would move in response to car use reduction measures, which is not consistent with a Swedish study by Gärling et al. (2000) that found that moving closer to work was not a likely response. In this case, it might matter that this survey concerned students, since it is easier for them, than a whole household, to move between different places.

Important attributes of public transportation

If public transportation was faster than driving, 80% of the students said that they would prefer it over driving themselves. This confirms the fact that the traveling time ratio between the car and public transport plays a critical role in the consumer's choice of transport (Priemus, 1995). Several students mentioned that the incidence that public transportation could be faster than driving was impossible and did not exist. However, in Europe for example, it is common that it is faster to ride a bike for short trips, or take a train for longer trips. This shows that Americans have few experiences of effective alternative modes.

improvements that most students asked for in the open ended questions were higher frequency, availability, and reliability.

Close to sixty percent of the students (57.7%) liked the idea of being able to do other things while traveling by public transportation, while 35.8% did not find the idea attractive. Some people mentioned that they thought that it was a good idea, but answered that it is not attractive to them since they get sick if they read while traveling. Considering the results from the survey, it might be beneficial to advertise this advantage in the United States as well.

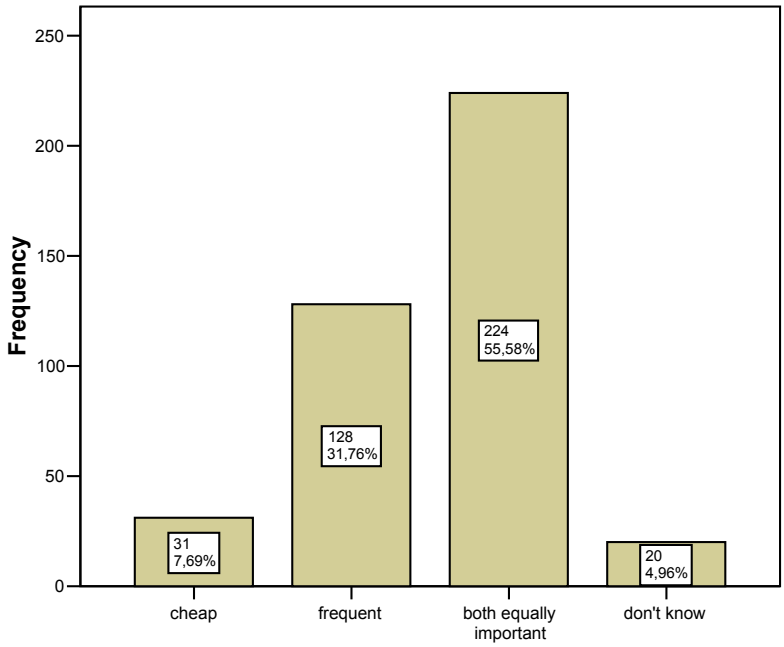

Figure 17. The relative importance of price and frequency in public transportation.

If public transportation was cheaper than driving, but took the same time, 67.3% of the students said that they would prefer it over driving. So influencing traveling time (quicker public transport, and slower car use) would most likely be effective (Priemus, 1995).

In a comparison between the frequency and price of public transportation, a majority (55.6%) of the students said that both attributes are equally important. A third (31.8%) thought that it is more important that public transportation is frequent, and 7.7% thought that it is more important that it is cheap (Fig. 17). The results above show that public transportation could be improved in West Lafayette, since the

Vehicle type

Most of the students had cars, but many showed an interest in owning a SUV. However, it was also popular to consider changing to a more fuel efficient car. Out of the students surveyed, 77.8% had cars, 19.6% had a truck or SUV, and 1.7% had some sort of environmental or very fuel efficient car.

Half of the students, 56% [57.8%], showed an interest for owning SUV's while 44% [42.2%] were not interested in having a SUV. If the students who already had a truck or SUV were excluded from the analysis, the results within the brackets were achieved. Despite the interest in SUV's, 84.9% of the students said that they would consider changing to a

more fuel efficient car. The popularity of this measure is most likely due to that it does not require any change in behavior.

The ranking of the incentives that would make the students choose a car instead of a truck or SUV was: (1) high gas price, (2) high insurance rate, (3) high registration fee, (4) and safety information (Fig 18). Only the students who showed an interest in owning an SUV were asked to rank these different options.

Campus

Out of the students surveyed, 54.4% had parking permits, and the majority was not willing to pay more than they do today. Several of the students that had parking permits lived less than 1.5 miles from campus. This meant that they had a campus housing parking permit, since Purdue only provided permits for people living more than 1.5 miles from Campus (Kemper, 2005). The students that had parking permits were also asked how much they were willing to pay for a permit. The answers ranged from $0-500 per year, with a mean of $95 and a mode of $60 (Fig. 19). Today most of the students pay $60 per year, so the results shows that the majority of the students were not willing to pay considerably more for parking permits than they do today. However, this issue is complicated since it is common for people to underreport what they are willing to pay. There is usually a difference between what people say they will do, and what they actually do. When a price change in fact occurs, the students may be willing to pay considerably more. Consequently, it is hard to know for sure if students will decide to use another mode of transportation when Purdue increases the prices of parking permits. An alternative solution could be to reduce the amount of parking lots/parking permits, since this seemed to affect the students.

The majority of the students did not think that it was a good idea to close of campus from private automobile traffic, and more than half of them preferred parking lots over green space on campus. Many of the students, 60.8% [62.5%], did not think that it would be a good idea to close off campus, and 27.3% [24.8%] thought that it would be. If the students that were living less than one mile from campus were excluded, the difference between yes and no became even greater and the answers within brackets were achieved. Some students were concerned that the housing prices on campus will go up too much if the campus master plan (p. 19) is implemented, and one student even mentioned that he/she would change university if this happened.

If Purdue had to choose between creating more parking lots and more green space and parks on campus, 47.1% of the students said that they would prefer more campus parking space, and 42.1% said that they would prefer more green space. People who drove to school frequently said that they preferred parking over green space (x^2=19.5, P<0.001), for all other modes of transportation, green space was preferred. This shows once again, that mode of transportation influence attitude.

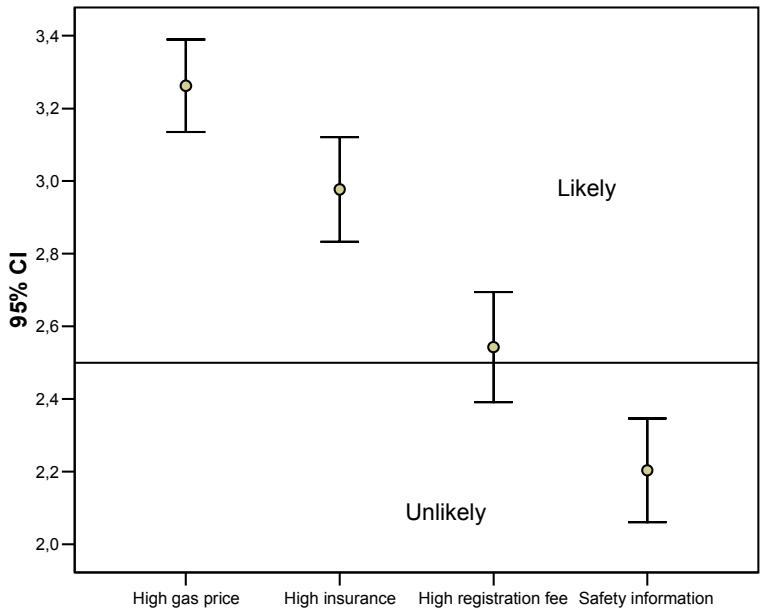

Figure 18. Incentives likelihood of making people buy a car instead of a truck or SUV. 1 is very unlikely and 4 is very likely. The error bars are showing the mean of the respondents' answers with a confidence interval of 95%.

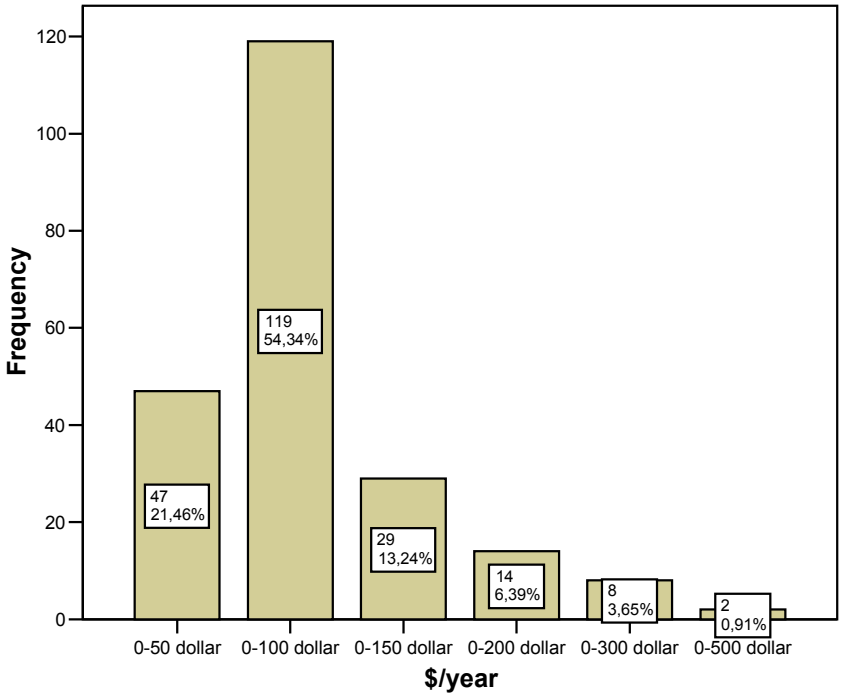

Figure 19. Distribution of the students' maximal amount that they were willing to pay for a parking permit. (Mean=$95.3, Mode=$60, N=219, Std.Dev.=70.2).

Demographic factors

Demographic factors that seemed influential were, gender, living distance from campus, size of city/town for upbringing, age, and education.

In general, women were more concerned with environmental issues or problems caused by automobile use, and they were more likely to change their behavior due to incentives. This is consistent with previous research about gender differences and environmentalism (Zelezny et al., 2000). The different relationships are displayed in table 5.

The female students found it important to reduce automobile use, believed that global warming is a human induced problem, and had concerns about automobile use. The male students were less likely to change their habits due to any policy, or have any concerns about automobile use. There was no difference between men and women in the number of trips per day, which correlates with the Guiliano & Narayan's (2003) conclusion that gender has no relationship with total number of daily trips. Concerning alternative modes of transportation, men were more likely to bike, ride a scooter, or motorcycle than women. Women on the other hand, were more likely to trip chain or car pool than men. This is consistent with previous research by (Gärling et al., 2000). Men were more often owners of trucks or SUVs, and less prone to want to change to a fuel efficient car. For all the different incentives aimed at reducing SUV ownership, women were more influenced and prone to choose a car instead of a SUV.

The students in the sample lived between 0.1-60 miles from campus (Fig. 9, p. 25). The mean was 4.3 miles, the median 2.25 miles, and the mode was 1 mile. Nearly two thirds (63.6%) of the students lived three miles or less from campus. Living distances from campus influenced several different factors. The further the students lived from campus the more often they drove to school (x^2=28.4, P<0.001), had a parking permit (x^2=127.5, P<0.001), used their car frequently (x^2=121.5, P<0.001), and drove more than three miles on the majority of their trips (x^2=35.9, P<0.001). The results from the survey showed that students that grew up in a big city or suburb were more prone to use other modes of transportation than the ones that grew up in a rural area (x^2=10.8, P<0.05). This supports the fact that car dependency is established early in life and influences future behavior (Mackett, 2003).

Young people (16-25 yrs) were less likely to change their habits due to any policy (x^2=7.1, P<0.05), and this difference was not due to a difference in gender. This is not consistent with the fact that younger people are more likely to be concerned about environmental issues (Golob & Hensher, 1998).

Since general problem awareness might be an influencing factor, the relationship with the students' majors was investigated. There was a relationship between opinion about global warming and major (x^2=21.5, P<0.01). It seems that students in liberal arts, agriculture, and education were more concerned about global warming than students in engineering and technology. However, this appeared to be a function of the fact that there was a difference in the number of men and women within these educational programs. The number of students was not sufficient to separate men and women within the different programs in order to investigate the issue further. Graduate students were more likely than undergraduate students to change their habits due to any policy (x^2=6.9, P<0.01). In general, it appeared that graduate students thought it is important to reduce automobile use, agreed that global warming is human induced, and had concerns about automobile use, but none of these differences was statistically significant. However, this could be the reason why young people were less likely to be concerned about environmental issues. The old people in this study were generally graduate students, who are likely to have a different background and educational experience than undergraduate students. This is consistent with the fact that educational level influence environmental behavior (Ewert & Prskawets, 2002).

Students with many roommates were more likely to car pool (x^2=6.9, P<0.05), compared to students living by themselves or with only one roommate. Many of the students (37.8%) received their primary financial support from their parents, while the rest were funded by different sources such as scholarships, working, student loans, or a spouse. The effectiveness of financial incentives did not seem to be related to the students' source of financial support.

When investigating the number of children and citizenship, no relationships could be investigated due to the small number of students with children (4.6%) or without American citizenship (7.5%). There was an under representation of international students in the sample, since there were 13% international students on campus at the time of the study. This may be related to the under representation of graduate students, since many of the international students are graduate students.

Table 5. Statistically significant differences between men and women. The numbers within parenthesis correspond with the question description within parenthesis. If the numbers do not always match the described difference in the text, the significant difference is caused by different degrees of the answer, for example a difference between answering likely or very likely, vs. unlikely or very unlikely

Question	% Women		% Men		x^2 Chi	P
Finding it important (unimportant) to reduce automobile use	30.8	(17.2)	27.9	(24.0)	4.2	<0.05
Agreeing (disagreeing) that global warming is a human induced problem	37.8	(9.7)	31.2	(21.3)	17.9	<0.001
Likely (unlikely) to change habits due to policies	23.6	(20.1)	23.1	(33.1)	5.1	<0.05
Having concerns (no concerns) about automobile use	31.3	(16.8)	28.3	(23.8)	4.8	<0.05
Likely (unlikely) to bike as alternative mode	25.3	(23.0)	34.6	(17.2)	9.1	<0.05
Likely (unlikely) to ride scooter as alternative mode	6.08	(41.8)	9.6	(42.5)	8.6	<0.05
Likely (unlikely) to ride motorcycle as alternative mode	7.3	(40.9)	19.3	(32.6)	40.0	<0.001
Likely (unlikely) to trip chain as alternative mode	40.7	(7.1)	40.0	(12.2)	17.5	0.001
Likely (unlikely) to car pool as alternative mode	41.46	(6.5)	38.94	(13.1)	27.0	<0.001
Having a truck or SUV (having a car)	5.5	(42.4)	13.5	(38.7)	13.5	<0.001
Likely (unlikely) to change to a fuel efficient car	46.0	(3.2)	43.7	(7.14)	5.9	<0.05
Likely (unlikely) to change to a car instead of truck or SUV due to the following incentives:						
high registration fee	29.0	(16.4)	22.7	(31.8)	22.1	<0.001
high gas price	40.5	(4.5)	41.4	(13.6)	10.9	<0.05
high insurance	33.9	(10.6)	34.9	(20.6)	10.4	<0.05
safety information (SUV less safe than car)	25.1	(20.5)	12.1	(42.3)	24.9	<0.001

CONCLUSIONS

Differences between the United States and Europe

The differences between the United States and Europe were smaller than expected. Despite the variations between the continents, there do not appear to be any great differences with regards to why people drive. American students did not seem to have any different attitudes than European households. Considering this, there is a great possibility to learn from each other and use research and experiences interchangeably.

In this study, the strongest reason for driving was convenience, which is consistent with European studies. However, Americans seem to be less concerned with environmental problems, and less likely to think that automobile use should be reduced. Nevertheless, more than half of the students (57%) still thought that it is important to reduce automobile use. This shows that there is public support for automobile use reduction. The majority (66%) also agreed that global warming is a human induced problem, which is somewhat unexpected considering that this issue is highly debated in the United States.

The Indiana Bureau of Motor Vehicles states that driving is a privilege (BMV, 2005). Despite this, 76% of the students considered driving to be a basic right, which should not be restrained by any policies. The frequency of this answer is probably unique to the U.S. and would not be reproduced in a European survey. Americans have a stronger sense of freedom and are not as used to being restrained by the government. This is an important cultural difference, which might affect the effectiveness and public acceptance of different policies. This was also confirmed by the fact that students who thought that driving is a basic right were less likely to change their habits due to any policies.

American students used a car more frequently than European students, and were more likely to say that it is their only option. It is important to keep in mind that the current situation in the United States is not the one with the most freedom. In order to enhance American freedom of choice, alternative modes of transportation has to be provided. The absence of alternatives to choose from is not freedom, and the more options people have, the better the market will be, and an optimal solution to the problems is more likely to be found (Sowell, 1996).

Proposals:

- Provide alternative modes of transportation.
- Emphasize that driving has negative side effects and is a privilege.
- Take advantage of experiences from European studies.

The effectiveness of different incentives, arguments, and policies

About forty percent of the students said that they were not likely to change their driving habits due to any policy. This result can be explained by factors such as non-supportive attitudes (believe that it is a basic right or not a problem), habits, lack of opportunity (no other option), or monetary costs (Stern, 2000). However, it was also indicated that the type of policy matters.

The most effective incentives to reduce automobile use were increased gasoline prices and improved public transportation. The new incentives that are available on the market today such as pay-as-you-drive insurance, parking-cash-out and tele-working, were also popular, and a majority said that they were likely to accept these incentives/offers. There was a consistent pattern of getting high rates of positive answers when the students were asked to try something new compared to when they were asked to give something up. The positive versus negative wording of the questions/incentives seemed to influence the answers. Incentives that did not require any change in driving behavior, such as changing to a fuel efficient car was also popular. The most coercive and effective incentives, such as closing of campus from private traffic, or reducing the amount of parking lots, were not as popular. Even so, these incentives and financial ones seem to be effective and important in order to reduce automobile use. Public acceptance is almost impossible to achieve when introducing a policy that restricts automobile use. However, the outcome can be positive and appreciated later on.

Health and safety arguments were the most effective for generating public acceptance for automobile use reduction measures. Arguments related to personal safety such as health (exercise), national security, and air pollution, were more effective than global issues such as climate change, biodiversity, and justice. Even if global warming was related to the local environment, is was not effective. In general, health issues, especially ones related to combating a sedentary lifestyle, seemed to be effective. This shows that the obesity epidemic in the United States can be a convincing reason for introducing automobile reduction polices.

Unexpectedly, religion did not seem to be an effective argument to motivate Americans to reduce their automobile use. Despite the prevalence of faith in the American culture, automobile use was no different from general studies about faith and environmental commitment. However, this study did not differentiate people who regularly attend church and people who do not. Therefore, this type of argument might be more effective in the context of people who fre-

quently attend church. It is also possible that students are less susceptible to this type of arguments, and that older generations could be affected in a different way. Nevertheless, in the context of previous studies it did not seem to be a valuable approach for the general public.

Proposals:

- Increase fuel prices.
- Increase parking prices.
- Offer pay-as-you-drive insurance.
- Offer parking-cash-out.
- Offer tele-working.
- Close off campus from traffic.
- Reduce the amount of parking lots and parking permits.
- Frame incentives in a positive way.
- Provide health related arguments.

Potential for reducing automobile use and using other modes of transportation

As expected, there is great potential to reduce automobile use and shift to other modes of transportation, especially when going to campus. Even if Purdue has taken action to limit automobile use on campus, more can be done. Most of the students still drive to school, even if they live close to campus, and the number of short trips by car is great. Of all the students, 64 percent live less than three miles from Purdue, and 46 percent of these students drive to the University. This would be a good target group for different kinds of incentives. In addition, for many students (36%), the majority of their trips were less than three miles. Moreover, as much as 57 percent of the students said that they were likely to use another mode of transportation. Most likely, there needs to be more incentives in place for them to actually do so. For instance, the future campus master plan appears to be a possible solution. The most popular alternative modes were public transportation, car pooling, and trip chaining.

It is easy to assume that automobile use would be less important to students compared to households, but the results from this study show that students are very car dependent as well. This indicates that there are few viable alternatives. Social expectations could also be an important factor since they influence young people even more than they influence adults.

Purdue University has done an excellent job regarding the improvement of public transportation. However, it seems like more can still be done. Of the students surveyed, 16 percent said that they would use public transportation if it was improved and it ranked very high as most likely alternative mode next to the car. An improvement in public transportation was also the kind of incentive that most likely could make the students choose another mode of transportation. Travel time ratio seemed to be very important. Most students would choose another mode if it was faster than driving, or just as fast as driving but cheaper. Purdue has made an effort to make public transportation inexpensive, but according to the majority of the students frequency and price is equally important. Many students also claimed that frequency is even more important than the price. Consequently, the bus needs to become more frequent, reliable, and if possible faster. If the service was better, people might be willing to pay for it as well. It could even be beneficial to introduce a small charge for the bus in order to improve its frequency. However, it is important to have in mind that these are hypothetical answers. It appears that studies of real experiences show that improvements in public transportation are not as effective since they primarily increase ridership among present users. Despite this, studies show that students are a susceptible population, and Purdue has already proved that improvements in public transportation can be very effective. By implementing the campus master plan and closing off campus from private traffic, public transportation and bicycling will be favored. Remote parking lots and reduced speed limits will make other modes even more favorable. Few students ride their bikes today, and the ones who do, live as close as one mile or less from campus. This shows that cycling is not a viable alternative today, and needs to be improved, especially since the students expressed a willingness to ride their bikes more.

The results showed that childhood area affected likelihood of using another mode of transportation. Students growing up in a city or suburb were more likely to use public transportation than the students growing up in a small town or rural area. This supports the fact that habits early in life are likely to prevail. Purdue University has an opportunity to make their students try alternative modes of transportation early in life and thereby establish environmentally beneficial habits and reduce prejudice about alternative modes of transportation. Time in college is usually the first opportunity the students live away from home and create their own lives and habits. This is also a limited time, which makes it likely that a forced change in behavior would be easier to accept. Consequently, this could be an opportunity for Purdue University to promote healthier and environmental modes of transportation, such as walking and bicycling, and in that way set a good example and create healthy habits among their students. Healthier students are more likely to do well in school, and it could be an important mission for the University to be a part of creating beneficial trends for the future.

Bad weather was frequently mentioned as a reason for not using alternative modes. It is impossible to improve the weather, but something that can be done

is to provide more bus shelters and covered bicycle parking. In addition, weather can not be one of the main determinants of bicycling or bus use, since places like Canada and Northern Scandinavia have among the highest rates of bicycling and public transportation. Habits, and what people are used to do, are probably much stronger determinants. In general, the interest for bicycling was low, but a possible way of encouraging bike riding could be to improve the safety, and have bike-to-school/work-days several times a year. By offering benefits for bike riding, new positive experiences and habits can be established.

Proposals:

- Focus efforts on trips shorter than three miles.
- Improve public transportation (speed, frequency, availability, reliability).
- Encourage walking and bicycling (improve safety, offer bike-to-work-days, provide new bike lanes, and covered bike parking).
- Encourage car pooling and trip chaining.
- Implement the campus master plan.
- Purdue University can focus on being a role model and create beneficial habits for the future.

Suggestions for future research would be to perform a national study in the United States with the same type of questions, to see if the results in this study are consistent with other states or other target groups. It would also be interesting to perform a study with European students using the same method and questionnaire, to determine possible differences compared to the United States. In order to investigate the issue with religion further, the questions could be asked only to people who frequently attend church, to see if they are efficient in that context. The statistics obtained in this study could also be further investigated with additional methods in order to extend the analysis. Moreover, the outcome of increased fuel prices, improved alternative modes of transportation, and forced changes in people's behavior could be studied in the United States. That way the theoretical effectiveness of these incentives could be compared to actual results. The effect of these incentives could also be compared to previous non American studies.

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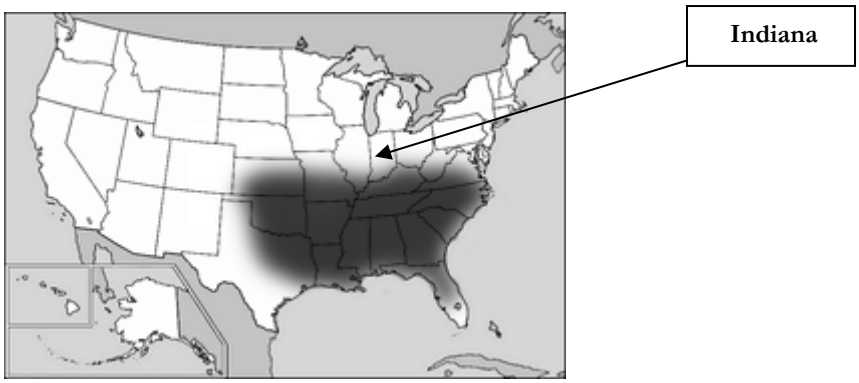
APPENDIX

Appendix 1 – The Bible belt



An area noted for religious fundamentalism; specifically, parts of the American South and Midwest (Answers, 2005).

Appendix 2 – Different incentives to reduce automobile use

Policy options from: Pucher (1998)
Car free pedestrian zones
Reduced speed limits
Increased right a way for bicycles and pedestrians
Lane restrictions (few lanes)
Preferential traffic signals for public transport
High motor vehicle fees
Increased fuel prices - fuel tax
Increased parking fees
Land use policies (high density, mixed land use)
Uniformed ticketing (same ticket for all types of public transport)
Park and ride, bike and ride facilities
Bike parking facilities
Separate bus lanes
Bus turnouts and loading bays
Better coordination of schedules between public transportation
Name monthly bus tickets "environmental tickets"
Improve speed, convenience and safety of walking and bicycling
Remote cameras for speed control
Wider bicycle lanes and sidewalks, and narrower streets
All streets two way for bikers
Eliminate free parking and street parking
Zone land for recreation, agriculture and forest

Policy options from: Diekstra & Kroon (2004)
Pay-as-you-drive insurance
Tax relief on collective car ownership
Reduced financial benefits for business cars
Increased registration fees, especially for SUV's

Policy options from: Vlek & Michon (1992)
Eliminate bottlenecks in current road system
Improve utilization of already existing roads
Minimize car's idling time
Promote car pooling with rewards, special lanes etc.
Promote spreading of daily working hours
Improve combined use of car and public transport
Stimulate use of taxis and taxi-sharing
Develop computer technology to plan shared trips
Continually urge people to use car only when unavoidable
Impose maximum number of kilometers per car-year
Increase value added tax on car purchases
Increase road taxes
Raise tolls and road pricing on busy roads
Publicly justify cars' expensiveness in view of stress on city life, human health, environment, transport infrastructure, and personal economy
Limit supply of road infrastructure
Reduced parking space in cities and towns
Limit access to cities and city centers
Close parks and recreational areas for motor traffic
Issue driving permissions for alternative groups on alternative days
Increase minimum age for obtaining driver's licence
Install annual car free days
Limit public media advertising for motor vehicles
Increase quality (frequency, speed, comfort, density, safety, privacy and reliability) of public transportation
Reduce public transport fares
Standardize public transportation nationally and internationally
Increase public knowledge of public transportation alternatives
Simulate competitive marketing of public transportation
Provide certain groups with low public transportation admission
Promote collective forms of employee transport
Develop and maintain system of school busing
Promote transport of goods by railway/waterway
Strengthen image of public transportation as an effective, reliable, pleasant, safe, social, and efficient system keeping cities livable and saving environmental resources
Promote use of bicycles with baggage facilities
Augment rights-of-way for cyclists
Facilitate possibilities of inexpensive bike renting
Develop strong anti-theft policies for bikes
Let purchasing and maintenance costs of bicycle be tax deductible
Strengthen the bike's image as a vehicle which is personal, flexible, available, safe, quick, profitable, healthy and environment protective
Promote location of new construction near public transportation
Stimulate compact city designs
Stimulate electronic media (mail and phone)

Appendix 3 – Questionnaire

Student attitudes about automobile use




If you live off-campus, and have an automobile (car, truck, SUV…) please answer the following questions. It will take about 10 minutes. This study is part of an individual research project, and not done on behalf of Purdue University. You are important to the success of this study, and your questionnaire will be treated confidentially. If you wish to comment on any questions or explain your answers, please feel free to use the space in the margins. Your comments will be read and taken into account. Please make sure that you answer the questions on both sides of each sheet of paper. Thank you for your help!

For each of the following, please either fill in the blanks or circle the number of the answer that <u>best</u> represents your opinion. IF you do not have an answer to a question, circle Don't Know.

1. How far do you live from campus? ……**miles**

2. What is your <u>primary</u> mode of transportation when going to campus (please circle <u>one</u> option)**?**

1 BUS
2 CAR
3 BIKE
4 WALK
5 OTHER (please specify)……..

3 a. Do you have a parking permit?

1 NO → go to question #4
2 YES

b. IF YES, what is the most that you are willing to pay for a parking permit? $……/year.

4. How often do you use your automobile?

1 SEVERAL TIMES EVERY DAY
2 5-7 TIMES/WEEK
3 3-4 TIMES/WEEK
4 1-2 TIMES/WEEK
5 1-3 TIMES/MONTH (or less)
6 NEVER
8 DON'T KNOW

5. How long are the majority of your trips? (a trip = every time you drive – anywhere!)

1 MORE THAN 3 MILES
2 LESS THAN 3 MILES
8 DON'T KNOW

6. What kind of vehicle do you drive?

1 CAR
2 TRUCK/SUV
3 ENVIRONMENTAL CAR (e.g. hybrid, fuel efficient, electric, alternative fuel….)
4 OTHER (please specify)……

Please answer the following questions by <u>clearly</u> writing your answer.

7. When you drive, what factors make you choose your automobile over other options?

8. What factors could make you refrain from using your automobile?

9. Are there any problems/issues caused by automobile use that worry you? If so, what are they?

Please answer the following questions by circling one number.

10. How important do you think it is to reduce automobile use?

Not important				Very important	Don't know
1	**2**	**3**	**4**		**8**

11. In my opinion, global warming is a human induced problem, caused by air pollution from carbon-dioxide, because of automobiles, etc.

Strongly disagree				Strongly agree	Don't know
1	**2**	**3**	**4**		**8**

12. In my opinion, driving is a basic right and an important part of American freedom. Therefore, no decision maker should limit my ability to use my automobile.

Strongly disagree				Strongly agree	Don't know
1	**2**	**3**	**4**		**8**

13. If you decided to limit the use of your automobile, which alternatives would you be likely to use?

	Very unlikely			Very likely	Don't know
a) Biking……	1	2	3	4	8
b) Walking……	1	2	3	4	8
c) Public transportation ..……..	1	2	3	4	8
d) Inlines/skateboard ..……..	1	2	3	4	8
e) Moped/scooter……..……	1	2	3	4	8
f) Motorcycle……..……..……	1	2	3	4	8
g) Trip suppression (decide not to go/choose alternative at home)	1	2	3	4	8
h) Trip chaining (conducting more errands per trip)……..….	1	2	3	4	8
i) Car pooling (go with someone else)……	1	2	3	4	8
j) Other(please specify)……..	1	2	3	4	

14. If you were making a long trip (e.g. to Chicago), which of the following would make it more likely you would choose another form of transportation than your automobile?

	Very unlikely			Very likely	Don't know
a) Cheap, fast and frequent public transportation…….. (e.g. a high speed train, or a shuttle with separate lanes, $10 one way)	1	2	3	4	8
b) Expensive highway tolls (e.g. $6 one way)……	1	2	3	4	8
c) Limited access ……..…… (e.g. fewer roads/lanes and a lot of congestion)	1	2	3	4	8
d) Limited parking at destination……..	1	2	3	4	8
e) Expensive parking at destination ……	1	2	3	4	8
f) A higher gas price (e.g. $4 per gallon)……..	1	2	3	4	8
g) Car pool lanes …….. (if you ride with someone else you can pass congestion in a separate lane)	1	2	3	4	8

15. When you choose not to drive, which of the following is the first, second and third most likely reasons? (Please rank your answers, by putting appropriate letter in each box below)

A TO STAY FIT/HEALTHY
B TO SAVE MONEY
C TO SAVE TIME
D TO SAVE THE ENVIRONMENT

1 ☐ MOST LIKELY **2** ☐ SECOND MOST LIKELY **3** ☐ THIRD MOST LIKELY

16. Now let's talk about shorter trips, such as around town or to campus, which of the following would make it more likely you would leave your automobile at home?

	Very unlikely			Very likely	Don't know
a) Cheap and frequent public transportation…….. (e.g. free busses every 10 minutes, 6 am – 11 pm)	1	2	3	4	8
b) Road tolls……... (e.g. $ 1-2 every time you enter a state road, or cross the Wabash)	1	2	3	4	8
c) Limited access…… (e.g. fewer roads and a lot of congestion)	1	2	3	4	8
d) A campus that is closed off from automobiles……. (e.g. only buses, biking and walking allowed)	1	2	3	4	8
e) Limited parking……..... (e.g. fewer and more remote parking lots)	1	2	3	4	8
f) Expensive parking…… (e.g. no free parking anywhere and more expensive permits)	1	2	3	4	8
g) A high gas price (e.g. $4 per gallon) ……	1	2	3	4	8
h) More bike lanes and paths…… (e.g. separate lanes all over campus, and West and East Lafayette)	1	2	3	4	8

Are there any other things that might encourage you to use another form of transport?

17. Politicians and scientists have presented a variety of reasons as to why it may be benecial to limit automobile use. Which of the following reasons would be likely to motivate you to refrain from using your automobile? (please circle one number)

	Very unlikely			Very likely	Don't know
a) Traffic related air pollution may be dangerous…….. to our health, and especially to our children.	1	2	3	4	8
b) Global warming and air pollution may decrease biodiversity, …… which is important to the health of our ecosystems.	1	2	3	4	8
c) Within one generation, global warming may cause extreme …….. weather events that may damage Indiana's farming.	1	2	3	4	8
d) Global warming may hurt the poor nations the most, and since …… the developed countries contribute to the problem the most, it is a matter of justice that we do something about it.	1	2	3	4	8

…cont. 17	Very unlikely			Very likely	Don't know
e) Within one generation, global warming may increase the likelihood of tropical diseases such as malaria in Indiana.	1	2	3	4	8
f) Protecting God's creation is an important part of our responsibility on Earth, therefore it is important that we try to protect our ecosystems and minimize the effects of global warming.	1	2	3	4	8
g) Reducing automobile use may increase walking and bicycling, which would be beneficial to our health.	1	2	3	4	8
h) Decreased automobile use, may decrease our dependency on foreign oil, which may increase our national security.	1	2	3	4	8

Next, we would like to ask you some brief questions, please answer by circling <u>the best</u> answer.

18. Are you likely to change your driving habits due to any policy or political incentives?
(e.g. taxes, fees, subsidies, bike lanes, better public transportation and so on)

1 NO
2 YES
8 DON'T KNOW

19. Would you consider changing to a more fuel efficient car?

1 NO
2 YES
8 DON'T KNOW

20. Would you give up your car if the registration fees on automobiles were twice as expensive?

1 NO
2 YES
8 DON'T KNOW

21. Would automobile insurance, that only charged you for as much as you actually drove, be of in terest to you? (e.g. if you drove less than most people, you would pay less)

1 NO
2 YES
8 DON'T KNOW

22. Is it likely that you would use any other mode besides automobile for everyday transportation?

1 NO
2 YES
8 DON'T KNOW

23. If driving was more expensive, would you be likely to move closer to campus?

1 NO
2 YES
8 DON'T KNOW

24. If public transportation was faster than driving, would you use it rather than drive yourself?

1 NO
2 YES
8 DON'T KNOW

25. How effective would the following alternatives be in making you decide to buy a car instead of a truck or SUV? (**if you would not want a SUV in the first place,** mark the box at the end of the question and move on)

	Not effective			Very effective	Don't know
a) If the registration fees on SUV's and trucks were twice as high as on cars	1	2	3	4	8
b) If the gas price was $4 per gallon	1	2	3	4	8
c) If the insurance rates were twice as high as on cars	1	2	3	4	8
d) If SUV's came with information that they are less safe than cars in some situations	1	2	3	4	8
e) Other (please specify)	1	2	3	4	8

☐ **I would not be interested in buying a SUV in the first place → go to question number 26**

26. If your current/future employer offered you to work from home a couple of days per week (tele-working), would you be interested?

1 NO
2 YES
8 DON'T KNOW

27. If Purdue had resources to fund one project in order to improve the central parts of campus, what would you value the most: improved on campus parking, or increased on campus green space e.g. parks?

1 PARKING
2 GREEN SPACE
8 DON'T KNOW

28. What is most important to you: that public transportation is cheap, or that it is frequent?

1 CHEAP
2 FREQUENT
3 BOTH EQUALLY IMPORTANT
8 DON'T KNOW

29. If public transportation took the same time as driving, but was less expensive, would you use it rather than drive yourself?

1 NO
2 YES
8 DON'T KNOW

30. Do you think it would be a good idea to close off campus from private automobile traffic? (e.g. in order to improve safety, health and the environment)

1 NO
2 YES
8 DON'T KNOW

31. If driving was more complicated (e.g. hard to find parking, limited speed, congestion), would you be likely to move closer to campus?

1 NO
2 YES
8 DON'T KNOW

32. Would you refrain from using your automobile to drive to work, if your current/future employer offered you monetary benefits (e.g. $100/month) for not driving to work?

1 NO
2 YES
8 DON'T KNOW

33. Would increased air pollution make you consider giving up your automobile?

1 NO
2 YES
8 DON'T KNOW

34. How attractive to you is being able to sleep, read, work, or do other things while travelling by bus or train?

Not at all attractive			Very attractive	Don't know
1	**2**	**3**	**4**	**8**

35. Would a sermon from a religious leader, explaining that air pollution harms God's creation and may cause issues of injustice among people, influence how much you drive?

1 NO
2 YES
8 DON'T KNOW

Finally, we would like to ask some questions about you, to help us interpret the results.

36. Your sex. (circle number for your answer):

1 MALE
2 FEMALE

37. How many children do you have? ……. (write number, 0 if you do not have any children)

38. How many people do you live with? …….. (write number, 0 if you live alone)

39. Are you an American citizen?

1 NO → write country of citizenship……
2 YES

40. What best characterizes where your family lived **most** of your childhood?

1 BIG CITY
2 SUBURBS
3 SMALL TOWN
4 RURAL AREA
8 DON'T KNOW

41. What student level are you at?

1 FRESHMAN
2 SOPHOMORE
3 JUNIOR
4 SENIOR
5 GRADUATE STUDENT

42. What is your primary source of financial support?

1 PARENTS
2 SCHOLARSHIPS
3 WORKING
4 STUDENT LOANS
5 OTHER (please specify)……

43. What is your major?.....

44. What year were you born?.....

Thank you for taking your time! Your answers are much appreciated!

If you would like to have the results and the report e-mailed to you, please provide your e-mail address on a separate sheet of paper.

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