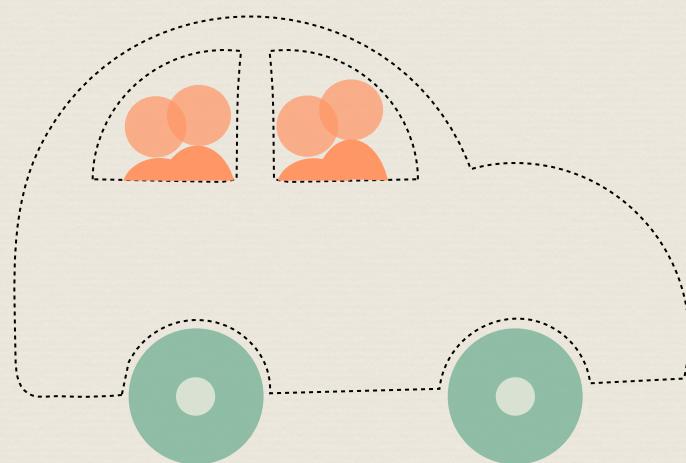




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## CARPOOLING FOR A BETTER WORLD



## INDUSTRIAL ANALYSIS REPORT

Global Manufacturing Strategy

Tsinghua University

2015

“ BY SHARING WE  
STAND  
PREPARED TO  
BUILD  
RELATIONSHIPS AND  
GIVE WINGS TO  
HUMANITY. ”



## A GROWING MARKET

The market of carpooling is much diversified. It include the individual user who shares his car with his colleagues, the student who user carpooling to have cheap travels and the one who use it to reduce his impact on environment.

We can group these different actors in the following categories:

- **Usage for daily travels**
- **Usage for long travels**
- **Carpooling organization inside a company**
- **Business companies proposing carpooling**
- **Institutional carpooling systems**



## REAL IMPACTS OF THE ENVIRONMENT



Even if this is not the first motivation of carpoolers, reducing the number cars on the road will reduce the pollution.

By taking the decision to use carpooling, the users can contribute to the protection of the planet.

This awareness regarding the environment is also a motivation for the companies to propose carpooling services for its employees and encourage them to reduce the CO<sub>2</sub> emissions at their scale.

## NEW TECHNOLOGIES

Dynamic carpooling consists on managing a continuous access to the carpooling available offers. A real time access is provided through a continuous updating of the offers and the demands

The popularization of smartphones, tablets, connected devices, free access to the Wifi, GPS, 3G, 4G, the ‘in real time’ became totally possible and accessible for all people.

Then the implementation of decentralized systems like Multi-Agent Systems (MAS) or Blockchain will help the market to grow. The objective of these Agents is to successfully associate the different users through an optimization process subjected to several, complex and variable constraints.



## PUBLIC POLICY AND SOCIAL ASPECTS

The market is highly dependent on the public policy and the social awareness. If these two aspects could be an opportunity, some public policies are obstacles for the development of this kind of markets.



Due to the high competition in the transportation industry, some countries prefer to protect the classic market from this kind of activities.

This IAR will study the differences of Law and Culture in different countries to try to highlight the points that are going to help this market.

# About Autors



## Massine AKILAL

« After a preparatory class in France, I entered an engineering school specialized in Mechanics and Energy. After two years in this school and an Internship in automotive industry, I decided to take a double degree program in Tsinghua University.

For me it was an opportunity to study abroad first and then to study Industrial Engineering completing my initial background in mechanics. »



## Morgane BARILLET-GENESTIER

« I am French and I have a professional bachelor in Quality Management.

After my graduation, I worked for Airbus SAS in Toulouse (France) for 1 year. I was in charge of several suppliers as Supplier Operation Manager in the Procurement team.

I finally had the opportunity to integrate the Industrial Engineering Department in Tsinghua University to do a Master degree in Management of Science and Engineering. It is a real chance for me to finalize my academic cursus and improve myself in a lot of domains. »



## Santiago COELLO

« I am from Guayaquil, Ecuador. I received my Bachelor Degree in Mechanical Engineering in ESPOL university, Ecuador.

I am a candidate master student in Management Science and Engineering, Chinese Program, at Industrial Engineering Department in Tsinghua University, focused in logistic and supply chain area."

**MyCHE<sub>车</sub>** is a group consisting of 3 graduate international students at Tsinghua University. They come from two different countries : France and Ecuador.

This report was written as a part of « Global Manufacturing Strategy' course by the Industrial Engineering Department during the Spring Semester 2015.

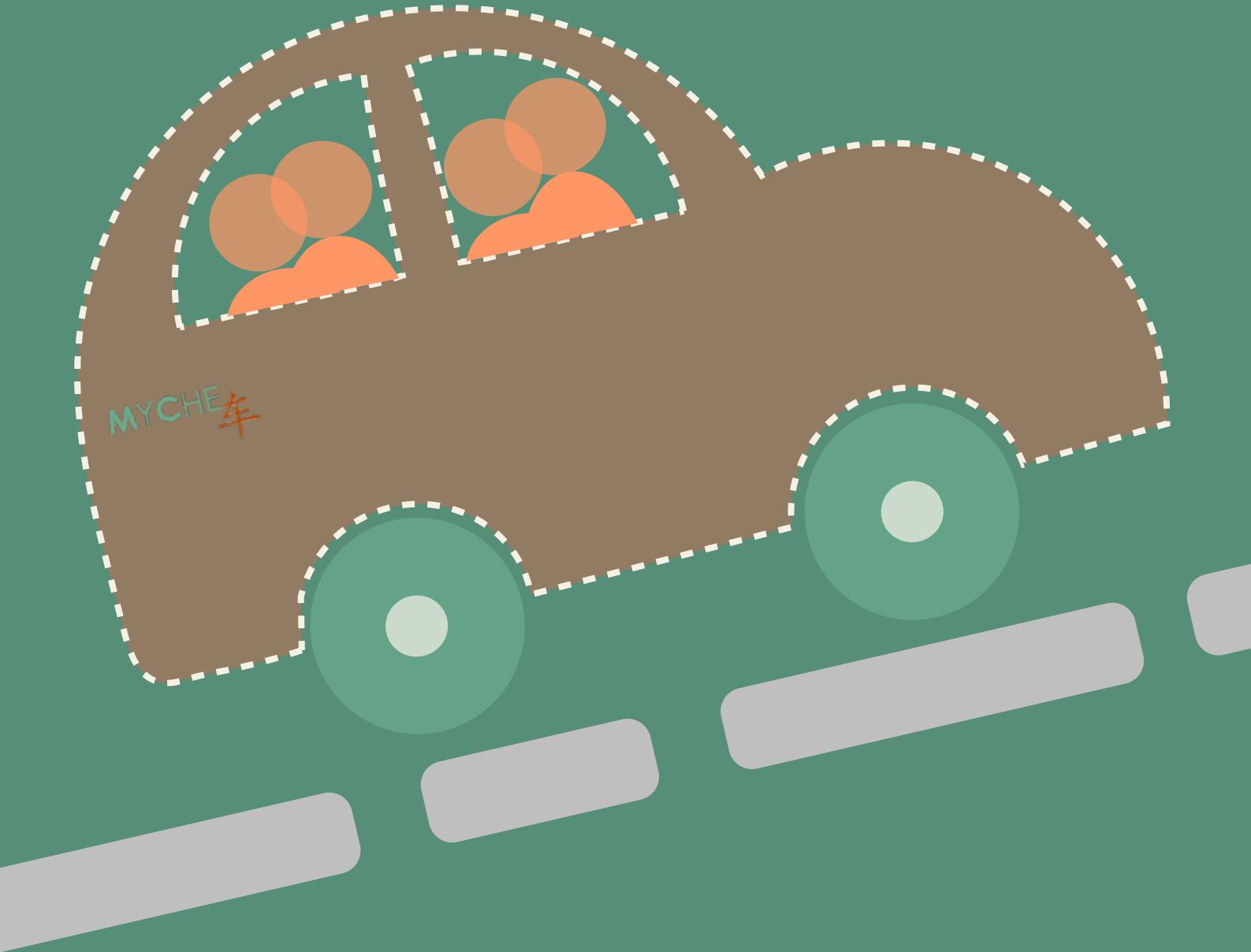
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The contents of this report deals with different elements : history of carpooling, market and technology analysis, law and public policy and social awareness.

Based on this, this report propose a discussion about the future of carpooling.

## Introduction

## Objective



## EXECUTIVE SUMMARY

## INTRODUCTION

Concept of Carpooling

Carpooling over the years

# TABLE OF CONTENT

## **PART I : MARKET ANALYSIS**

Market size and growth

Real-time ridesharing services

Some companies examples

Transportation cost

Traffic Flow

## **PART II : TRANSPORTATION ANALYSIS**

...

## **PART III : TECHNOLOGY ANALYSIS**

Used technologies

Limited possibilities

Technologies to boost the market

## **PART IV : LAW AND PUBLIC POLICY**

Countries examples

Governments actions

## **PART V : SOCIAL AWARENESS**

Motivations

## **PART VI : CHALLENGES**

## **CONCLUSION**

## **APPENDIX**

## EXECUTIVE

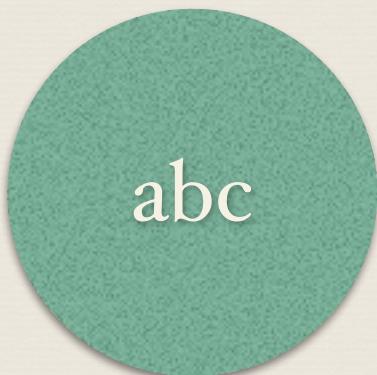
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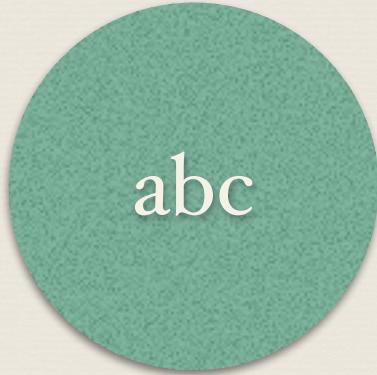
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# Introduction

## Concept of Carpooling

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Carpool commuting is more popular for people who

work in places with more jobs nearby, and who live in places with higher residential densities. Is significantly correlated with transport operating costs, including gas prices and commute length, and with measures of social capital, such as time spent with others, time spent eating and drinking, and being unmarried. Is significantly less likely among people who spend more time at work, older workers, and homeowners.



Carpooling - Wikipedia

## Carpooling over the years

1

World War II car sharing clubs  
(1942-1945)

2

Energy crises (1970-1980)

3

Early organized ride sharing schemes  
(1980-1997)

4

Reliable ride sharing systems  
(1999-2004)

5

Technology-enabled ride matching  
(2004-today)

## 1942-1945

## World War II car-sharing clubs

Focus on conserving resources for the war. Car sharing clubs exchange and self-dispatching system. Matched riders and drivers via bulletin at work.

Propaganda for Carpooling during the Second World War. Sources: Oregon State Archives, US Archives and Records Administration

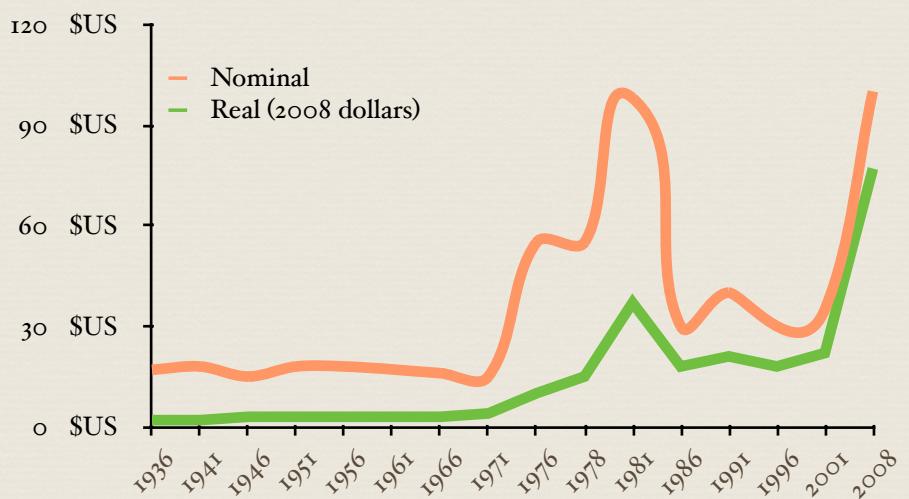


## 1970-1980

## Major responses to the energy

Grew significantly in the 1970s in response to the energy crisis and the Arab oil embargo of 1973 to 1974. Focus on conserving fuel. Employer and government sponsored ridesharing projects.

### Oil Prices



## **Early organized ride sharing schemes**

**1980-1997**

Focus on mitigating traffic congestion and air quality issues.  
Telephone based ride matching.

## **Reliable ride sharing systems**

**1999-2004**

Focus on mitigate traffic congestion. Online ride matching services.  
Traveler information services.

## **Technology-enabled ride matching**

**2004-today**

Focus on reducing climate change. Financial incentives for “green trips” through sponsors. Growing dependence on foreign oil and traffic congestion. Partnerships between ride matching software companies and regions and large employers. Internet, mobile phones, and social networking platforms. Real time ride sharing services.

# Part I



# Market Analysis

## Part I: Market Analysis

In 2010, 1 000 millions cars passed

In 2004, 87 millions cars were produced

This period encompasses the fifth ride sharing phase, called: “technology-enabled ride matching”. In this period is most notable for the widespread integration of the Internet, mobile phones, and social networking (i.e. an online community where individuals connect and interact) into ride sharing services. At present, the majority of North American ride matching services use online websites as their chief technology medium. Many of them are based on a ridesharing software

platform purchased from a private company. As of July 2011, there were approximately 12 such companies in North America that offer this software. (E.g. Ecology and Environment, Inc. offers Green Ridew, and Pathway Intelligence Inc. provides Jack Bell Ride-Share). While the abundance of online ridesharing systems is promising, it has resulted in disparate, non-standardized databases that leave many programs with a lack of critical mass.

There are approximately 638 ride matching programs in North America.

As of July 2011, the authors estimated that there were 638 ride matching services in North America, based on an extensive Internet search. This tally includes both online (most have an Internet-based component) and offline carpooling and vanpooling programs. Those located in sparsely populated

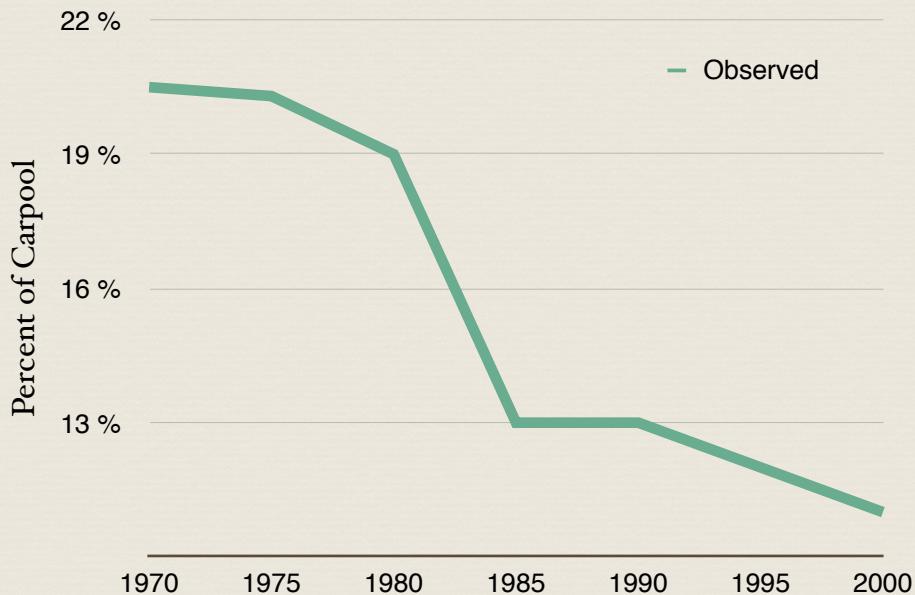
rural areas, which appeared to have very low use, were excluded. Institutions that have their own ride matching website but employ a common platform were each counted separately. Of the total, 401 are located in the USA, and 261 are in Canada (24 programs span both countries). Carpooling attracts the largest focus, with 612 programs offering ride matching, and 153 providing vanpool ride matching; 127 offer both.

The future is the share economy

3 000 million people have access to internet

## Market size and growth

### Observed carpool trend in the United States 1970-2000



Source: The rise and fall of the American carpool: 1970–1990, Erik T. Ferguson & Associates, P.O. Box 888729, Dunwoody,

### International comparison of work trip modes shares.

| Nation        | International Comparison of Work Trip Mode Share |                             |                |        |        |       |                          |
|---------------|--|-----------------------------|----------------|--------|--------|-------|--------------------------|
|               | Personal Vehicle, Driver                         | Personal Vehicle, Passenger | Public Transit | Walked | Cycled | Other | Carpool & Public Transit |
| United States | 78.2%  | 12.6%                       | 4.7%           | 3.0%   | 0.4%   | 1.0%  | 17.3%                    |
| Canada        | 73.8%  | 6.9%                        | 10.5%          | 6.6%   | 1.2%   | 1.0%  | 17.4%                    |
| UK            | 62.0%  | 8.0%                        | 14.0%          | 11.0%  | 4.0%   | 1.0%  | 22.0%                    |
| Australia*    | 71.0%  | 7.6%                        | 8.5%           | 4.7%   | 1.2%   | 7.1%  | 16.0%                    |

Sources: US Census, 2000 Journey to Work, StastCan, 2001 Commuting Patterns of Canadians, UK DfT, 1999 National Travel Survey, ABS, 2001 Census of Population & Housing

### North American Ride matching Services (July 2011).

612 Carpooling

143 Vanpooling

Sources: ITS Berkeley, Transportation Sustainability Research Center

## Ride matching platform partnerships

From 2004 to the present, a new generation of ride matching platforms has been developed for regions and employers to use. Moreover, there has been significant growth and overall success with this strategy. Partnerships between ride matching software companies and its large-scale clients take advantage of existing common destinations and large numbers of potential members. These firms sell their ride matching software “platforms” to public agencies and employers, which are sometimes used as standalone websites for each group. While this partnership strategy has gained more users than previous ridesharing phases, it is most suited for commuters with regular schedules.

## « Green trip » sponsored incentives

Many public agencies and companies promote ridesharing by providing its members with incentives. One example is NuRide—an online ridesharing club with over 63 000 members in seven US metropolitan areas (NuRide, 2011). NuRide rewards points when members carpool, vanpool, take public transit, bike, walk, or telecommute for both work and personal trips. These points can be used for restaurant coupons, shopping discounts, and attraction tickets. NuRide partners with public agencies, employers, and businesses to sponsor the incentives. Similarly, RideSpring works with employer commute programmes and participating employees can enter monthly drawings for prizes from over 100 retailers (RideSpring, 2010).











## Executive Summary

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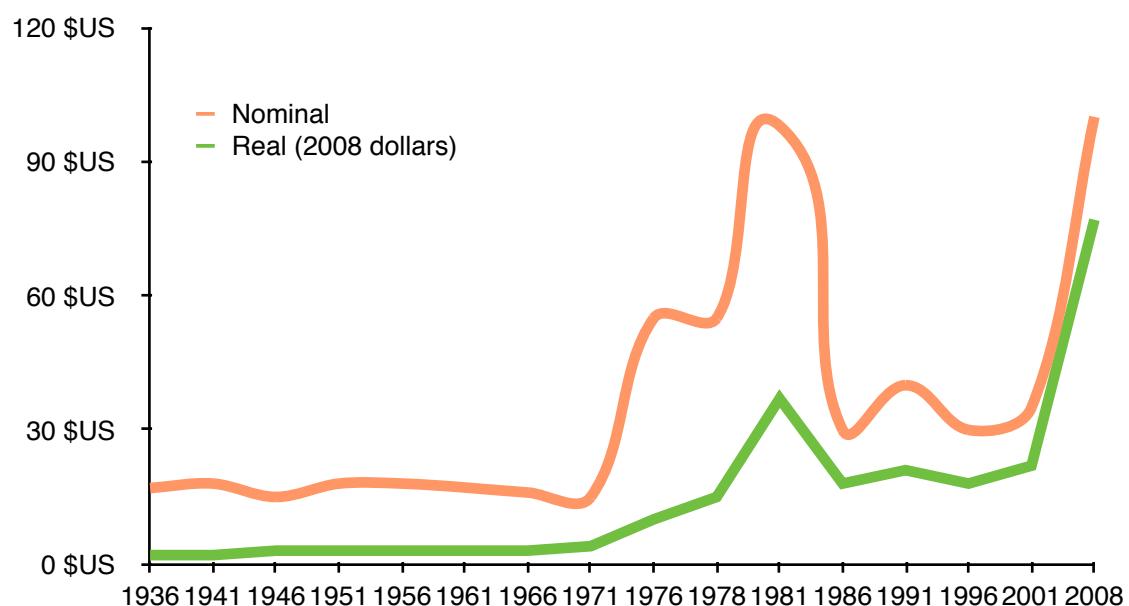
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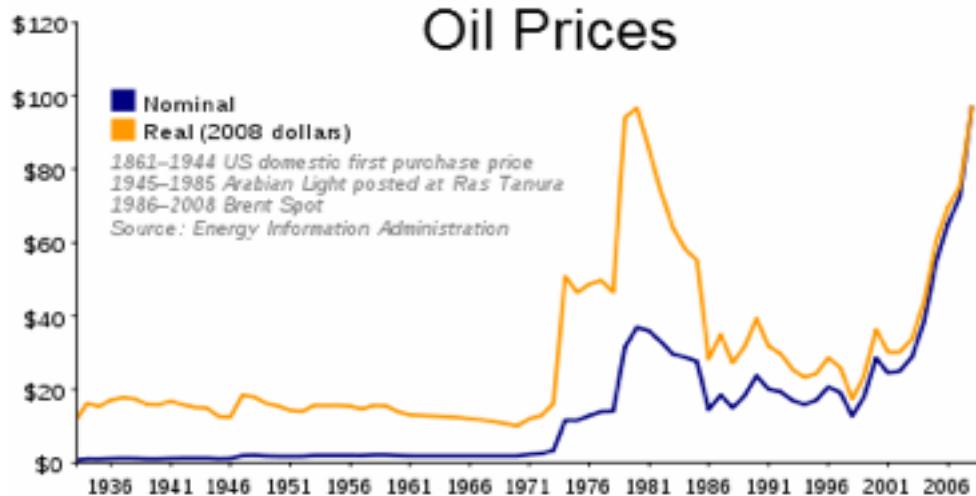




Fig. 3 Cars wait in long lines during the gas shortage in 70's

#### Early organized ride sharing schemes (1980 - 1997)

Focus on mitigating traffic congestion and air quality issues. Telephone based ride matching.

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Focus on reducing climate change. Financial incentives for "green trips" through sponsors. Growing dependence on foreign oil and traffic congestion. Partnerships between ride matching software companies and regions and large employers. Internet, mobile phones, and social networking platforms. Real time ride sharing services.

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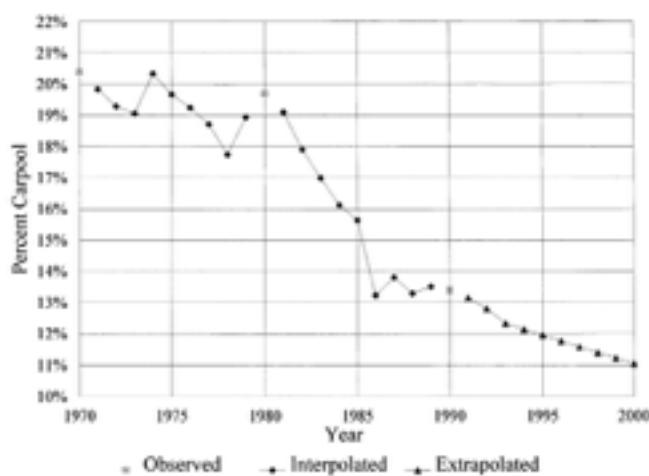


Fig. 4 Interpolated and extrapolated carpool trends in the United States 1970-2000. Source: *The rise and fall of the American carpool: 1970–1990*, Erik T. Ferguson & Associates, P.O. Box 888729, Dunwoody, Georgia 30356, USA

| International Comparison of Work Trip Mode Share |                          |                             |                |        |        |       |                          |
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Fig. 5 International comparison of work trip modes shares. Sources: US Census, 2000 Journey to Work, StastCan, 2001 Commuting Patterns of Canadians, UK DfT, 1999 National Travel Survey, ABS, 2001 Census of Population & Housing



Fig. 6 North American Ride matching Services (July 2011). Sources: ITS Berkeley, Transportation Sustainability Research Center

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### Social networking platforms

The rise of social networking platforms, such as Facebook, has enabled ridesharing companies to use this interface to match potential rides between friends or acquaintances more easily. These companies hope that social networking will build trust among participants, addressing safety considerations. One example is Zimride, which has partnered with 86 US and Canadian colleges, universities, and companies that each has their own "network" of members (Zimride, 2011). In addition to each network's website, Zimride also uses the Facebook platform to attract public users. Another service is PickupPal (2011), with over 156 000 members in 120 countries. It allows members to create their own groups based on common area, company, school, and shared interests. However, social networking may limit itself by relying on more isolated groups and excluding less tech-savvy users. At present, there are four major North American ridesharing programmes focused on social networking: GoLocoTM, Gtrot, PickupPal, and Zimride.

### Real-time ridesharing services

In North America, two companies are beginning to offer real-time ridesharing services: AvegoTM and Carticipate. Real-time ridesharing uses Internet-enabled "smartphones" and automated ridematching software to organize rides in real time. This enables participants to be organized either minutes before the trip takes place or while the trip is occurring, with passengers picked up and dropped off along the way. These programmes attempt to address the inconvenience of traditional carpooling and vanpooling. As in most ridesharing services, a high subscriber base is required. These key developments and their target journey purposes are summarized in Table 3.

## Some companies

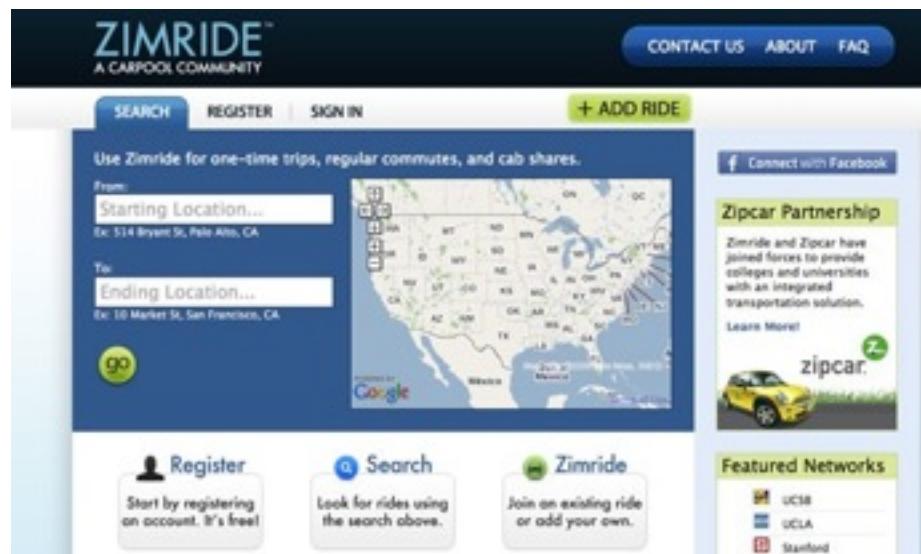


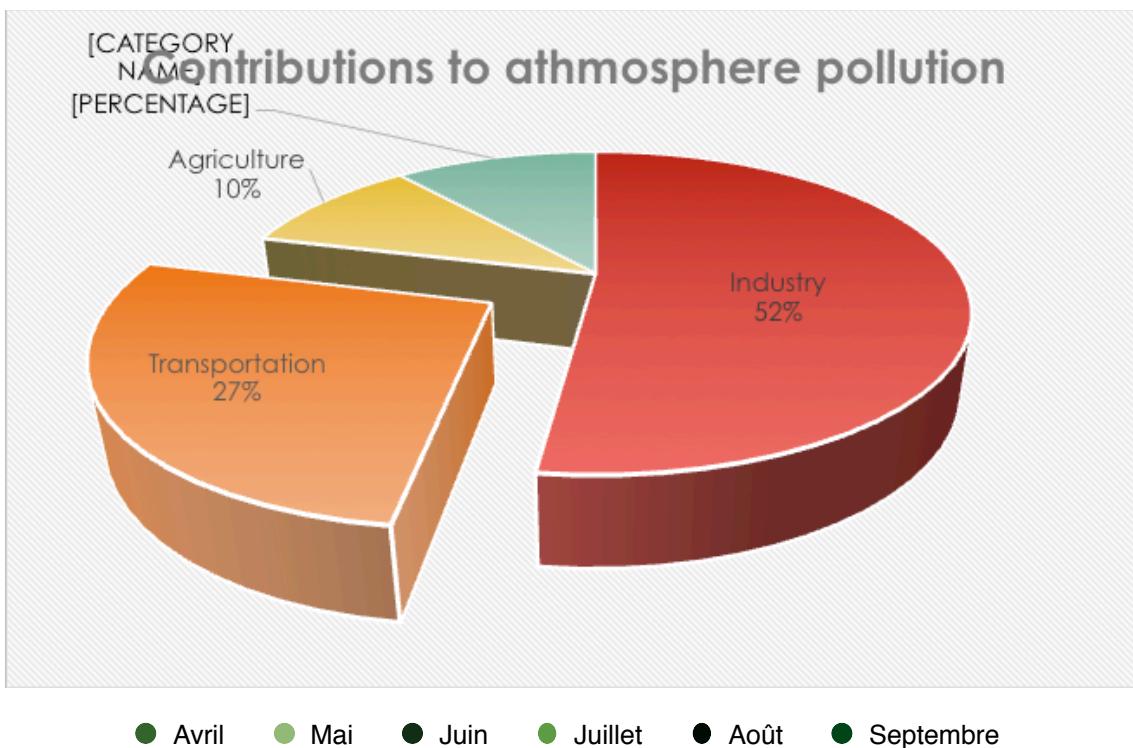
Fig. 7 Zimride.com: Ridesharing with Facebook (USA)



Fig. 8 Nuride.com

## Part 2: Transportation Analysis

### Environment Impacts



● Avril ● Mai ● Juin ● Juillet ● Août ● Septembre

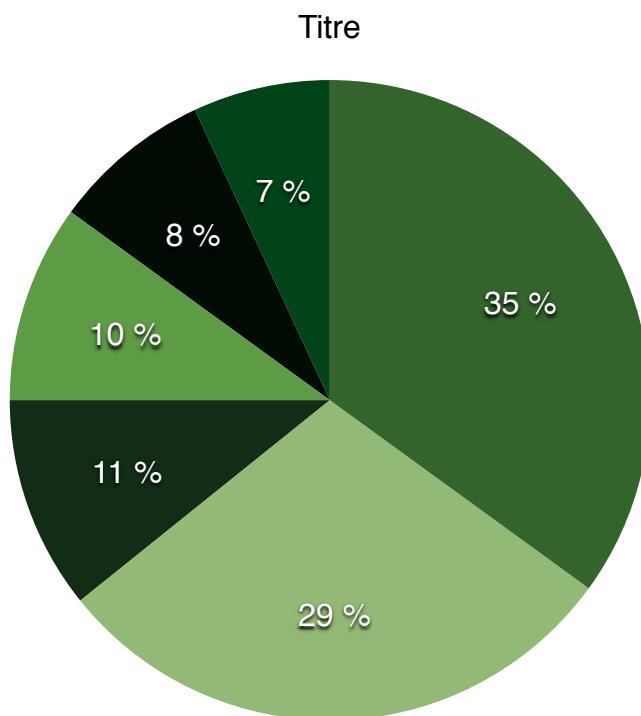


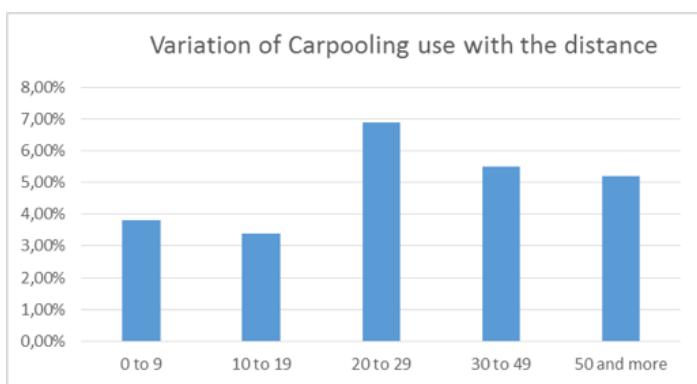
Fig. 9 Contribution on transportation to the atmosphere pollution. Source <http://www.ec.gc.ca>

The part of atmosphere pollution due to the transportation is very high in the big cities. For these areas, we consider that the transportation by road is the first responsible of emission of NOx and PM10 particles. The process of emission of those particles is:



- The VOC (Volatile organic compounds): those particles are emitted directly from the exhaust of cars.
- NOx: some of those particles are emitted by the engine and some others are produced by chemical reactions in the atmosphere due to the NOx emitted.
- PM10 and PM2.5 are emitted or created by the VOCs. Their volatility is due to the traffic.

In this part we are going to calculate the ecological impact of using carpooling. We are limiting our study of ecological impact to the CO2 emission during the travels. Our statistics are collected from the last ENTD (a French study which is made each 10 years to know how French people are traveling). The study was made with a sample of 20200 representative households of the national (France) tendency.



Those figures are showing that the most important use of carpooling is related to travels between 20 and 30 km.

Fig. 10 Variation of Carpooling use with the distance. Source ENTD 2010

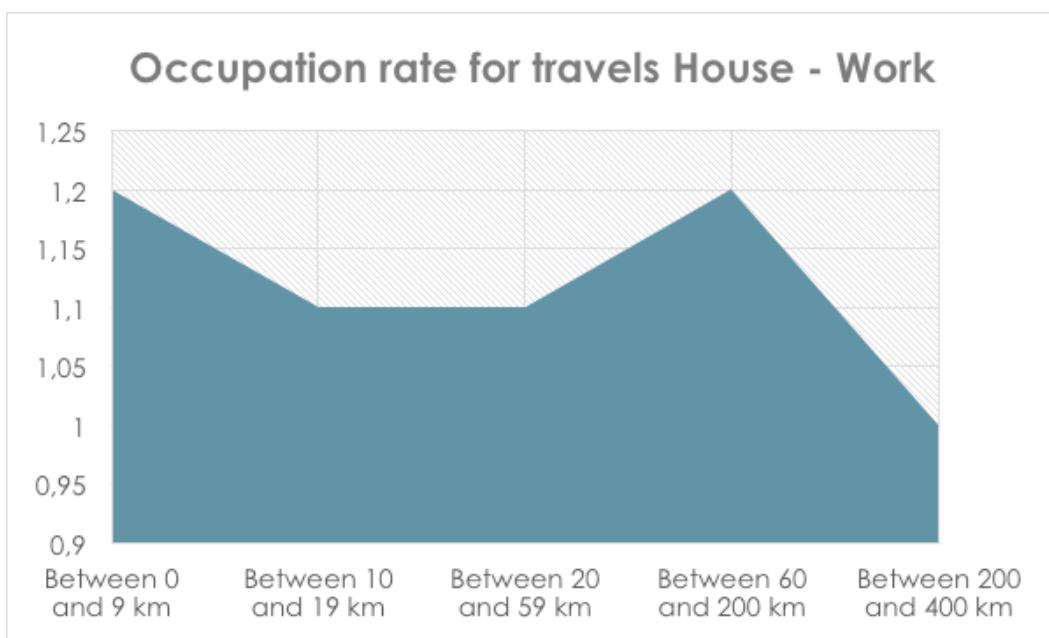


Fig.11

Variation of occupation rate for a type of travels. Source ADEME 2013

## Short Distance Trips

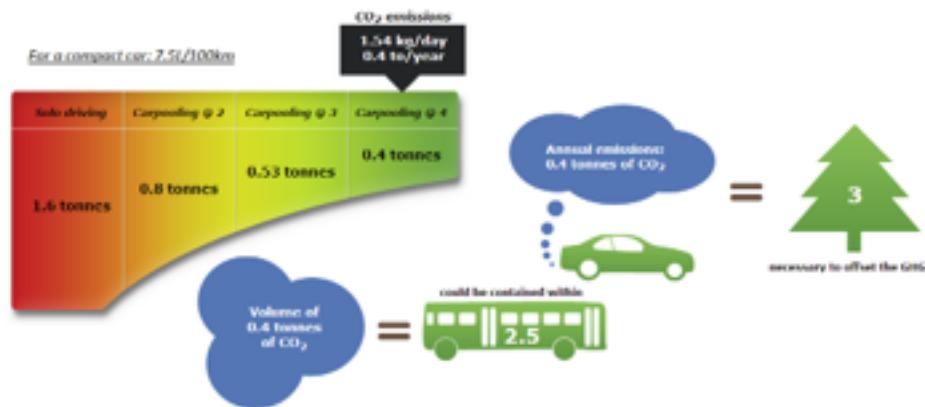


Fig. 12 CO<sub>2</sub> Emissions for different scenarios with small car. Source Canadian ministry of transportation

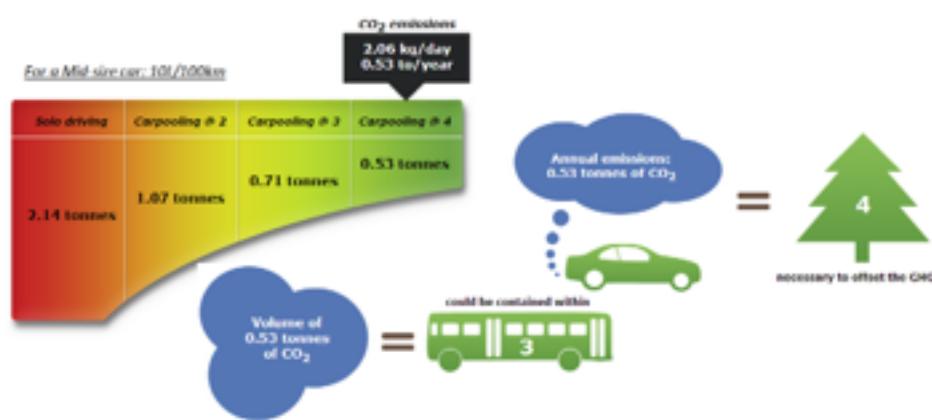


Fig. 13 CO<sub>2</sub> Emissions for different scenarios with medium car. Source Canadian ministry of transportation



Fig. 14 CO<sub>2</sub> Emissions for different scenarios with SUV. Source Canadian ministry of transportation

We learn from ENTD's figures that, the mean distance between house and work place is 14.7km.

This simulation is made for:

- round trip
- 5 working days per week and
- 52 working weeks in the year.

We learn from ENTD's figures that, the mean distance between house and work place is 14.7km.

This simulation is made for:

- round trip
- 5 working days per week and
- 52 working weeks in the year.

Increasing the occupation rate

From 1.2

To 2



Will reduce the CO2 emissions by

0.71 Tonnes

Per Year, per Car



With



=

- 12%

Of the total emitted in France by transports

## Long Distance Trips

From the previous part, we estimated the emission due to short travels and the potential to reduce this value.

Regarding the percentage of long distance trips, and by ponderation operation, we estimate the total reduction of CO2 emissions in France

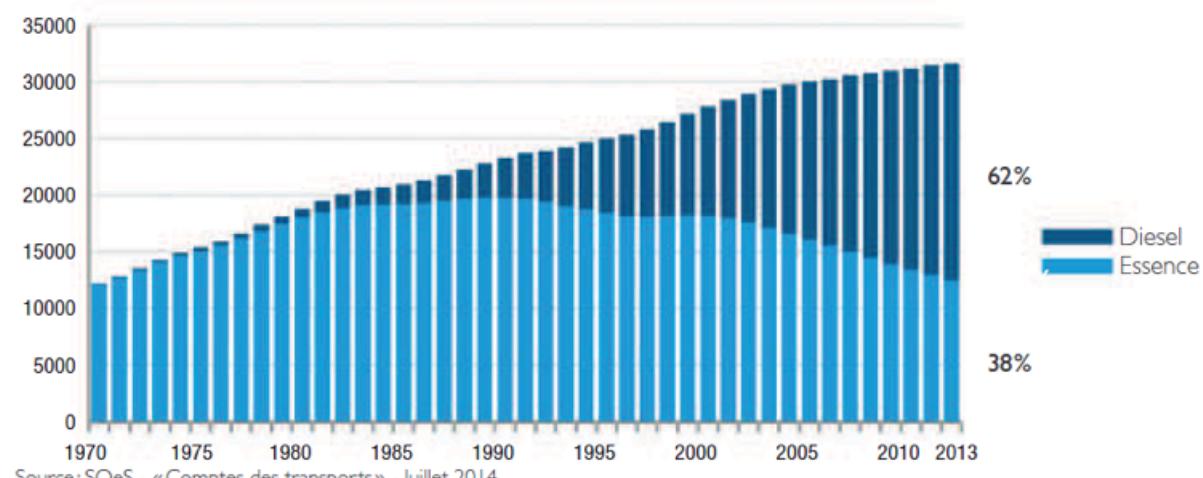


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## Transportation Cost



## Traffic Flow

## Part 3: Technology Analysis

Used Technologies

Limited Possibilities

Technologies to boost the market

## Part 4: Law and Public policy

### Countries Examples

#### China



The Directorate General for Competition, Consumer Affairs and Fraud Control ( DGCCRF) points out in a press release of February 7, 2014 , that carpooling is permissible under the condition that it is free or that the money paid by people transported corresponds to a cost sharing generated by the use of the vehicle.



#### USA

The Directorate General for Competition, Consumer Affairs and Fraud Control ( DGCCRF) points out in a press release of February 7, 2014 , that carpooling is permissible under the condition that it is free or that the money paid by people transported corresponds to a cost sharing



## Government Actions

## HOV Lanes

### High Occupancy Vehicle Lanes



*Restricted traffic lane reserved at peak travel time or longer for the exclusive use of vehicles with a driver and one or more passengers.*

## HOV Lanes

All over the world



## Part 5: Social awareness

### Motivations

#### Oil Prices and Carpooling

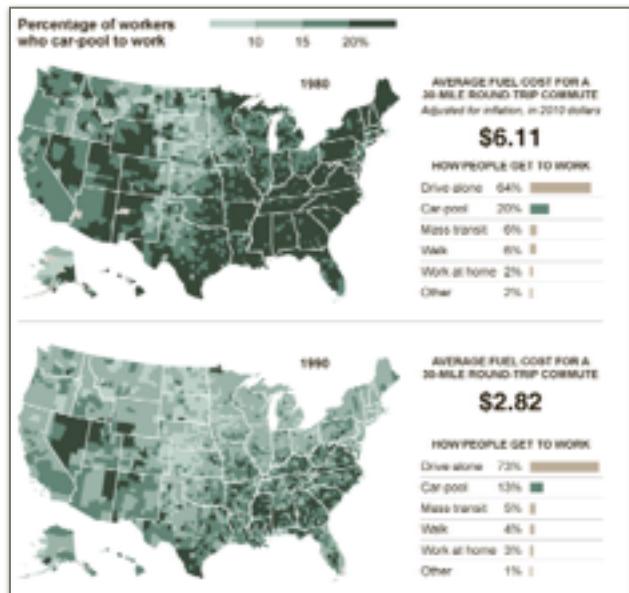
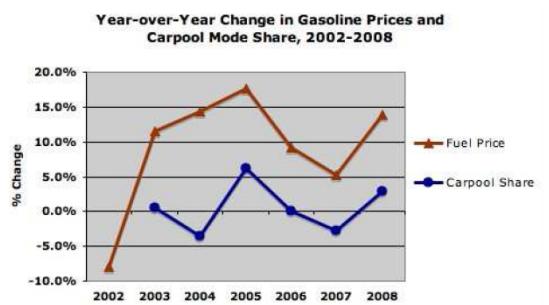
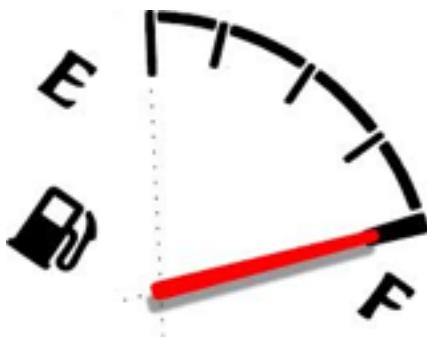


Fig. 13 Relation between oil prices and carpooling, Park, Haeyoun; Gebeloff, Robert (28 January 2011). "Car-Pooling Declines as Driving Becomes Cheaper". The New York Times

## Motivations for Carpooling

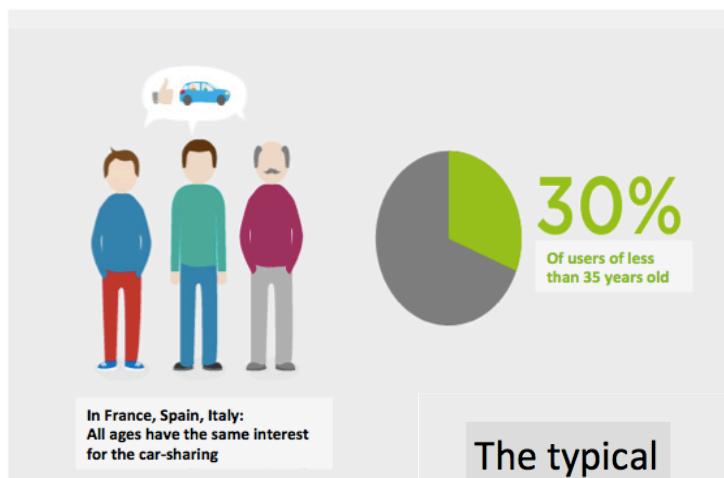
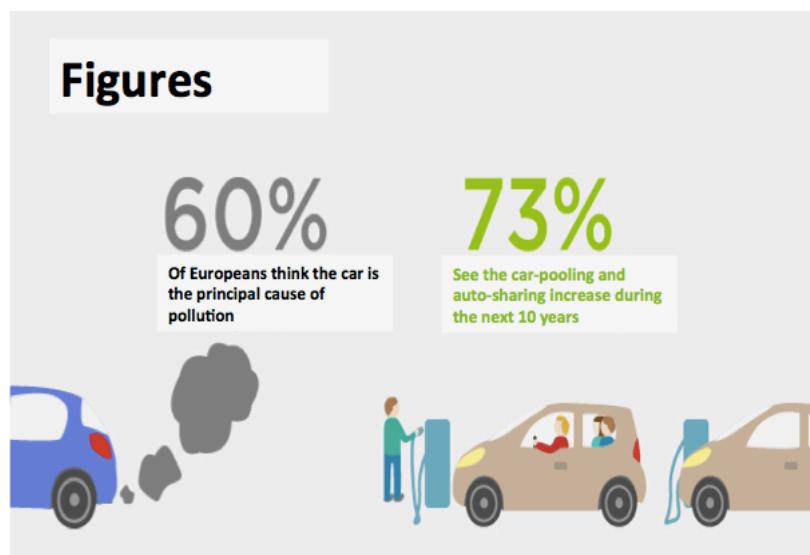
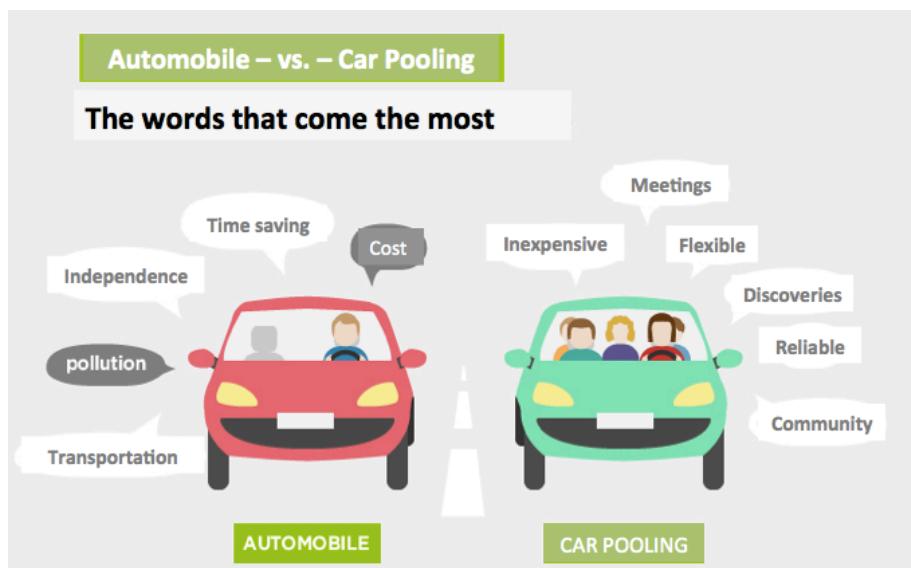
| Factor                           | Frequency Selected | % of Total (N=789) |
|----------------------------------|--------------------|--------------------|
| Sharing vehicle expenses         | 703                | 89                 |
| Access to HOV lanes              | 699                | 89                 |
| Enjoy travel with others         | 691                | 88                 |
| Travel time saving               | 690                | 87                 |
| Preferred parking at work        | 687                | 87                 |
| Help environment and society     | 684                | 87                 |
| Carpool partner matching program | 680                | 86                 |
| Encouraged by program at work    | 677                | 86                 |
| Drop off kids at school/day care | 674                | 85                 |
| Reliabilityy of arrival time     | 666                | 84                 |
| Slitting tolls on toll roads     | 159                | 20                 |
| Other                            | 109                | 14                 |
| Get work done while traveling    | 79                 | 10                 |
| Relaxation while traveling       | 77                 | 10                 |

## Reasons for not Carpooling

| Main Reason                                 | Frequency Selected | % of Total (N=789) |
|---|--------------------|--------------------|
| Location and schedule limitation            | 1682               | 55                 |
| Travel flexibility                          | 1394               | 45                 |
| Need a vehicle during the day               | 1190               | 39                 |
| Need to make other stops during trip        | 862                | 28                 |
| Appreciate alone time                       | 567                | 19                 |
| No program to encourage me                  | 417                | 14                 |
| Other                                       | 248                | 8                  |
| Like to listen to radio that others do not  | 175                | 6                  |
| Potential partners have disagreeable traits | 125                | 4                  |

# With who you carpool

| Type of Carpooler                | HOV2      | HOV3+     |
|----------------------------------|-----------|-----------|
|                                  | Frequency | Frequency |
| Adult family member              | 335       | 94        |
| Coworker, nearby office building | 141       | 51        |
| Child                            | 91        | 95        |
| Casual carpooler                 | 22        | 14        |
| Neighbor                         | 17        | 10        |
| Other                            | 33        | 7         |

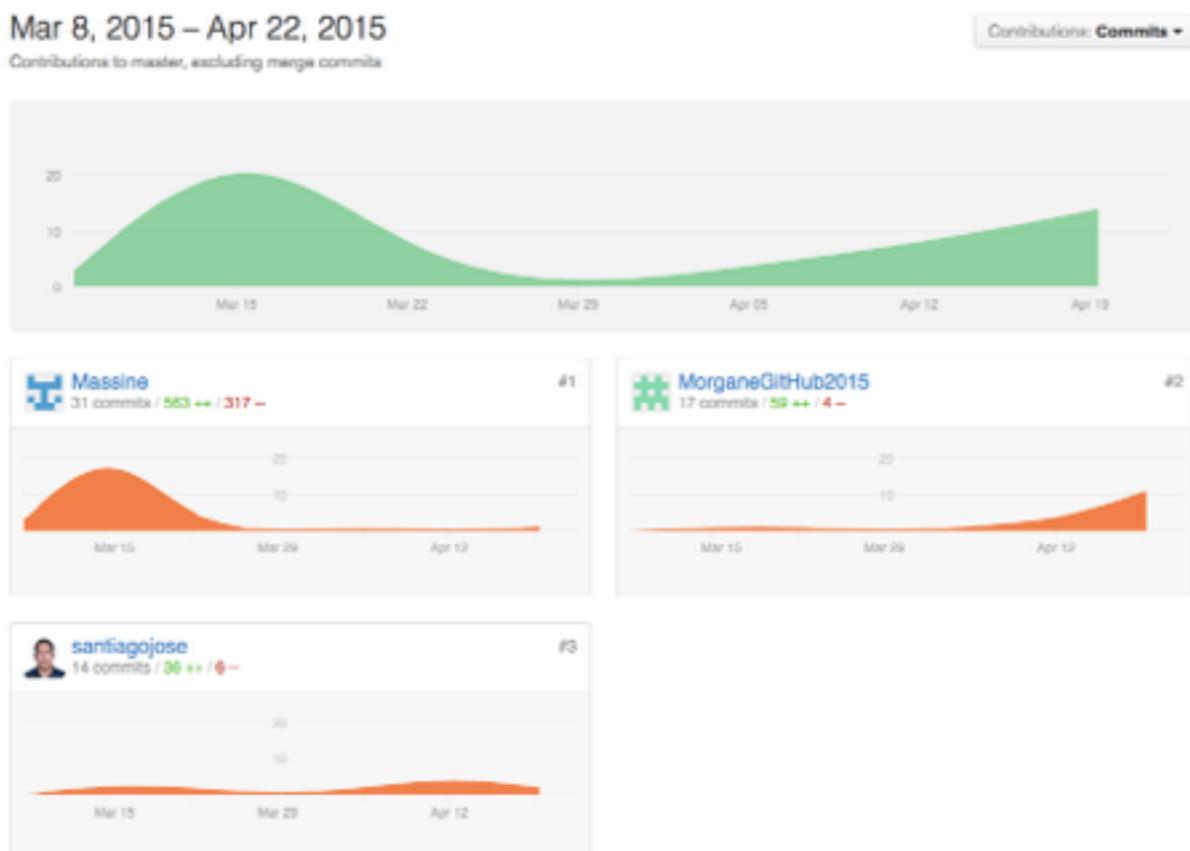


## Part 6: Challenges



## Appendix

GitHub



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