

# **Experiments on Car sharing and Electrification in Gothenburg**

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# Case study in transport

- A case study of car owners and their cars in Gothenburg
- To what extent will a shift towards electrification and car sharing affect total life time CO2 emissions from passenger vehicles in Gothenburg



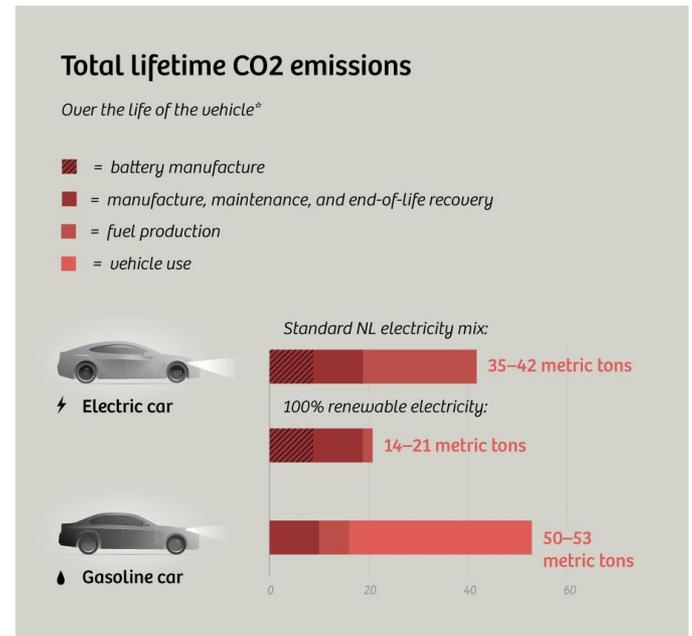
# Case study in transport

- Identify determinants that make car owners switch from
  - 1) fossil to electric cars
  - private car
  - 2) ownership to car sharing
  - 3) non-ownership to car sharing



# Why is this important?

- Predict behavior and understand the potential of changing individual behavior to successfully reduce carbon emissions from electrification and car sharing
- Understand how to design policy instruments for electrification and car sharing as a potential supplementary transport mode to reduce carbon total life cycle emissions.
- LCA from ongoing project as input



# How do we do it?

- A discrete choice experiment on 1 000 car owners in Gothenburg to study their choices and test the relevance of different attributes.
- Discrete choice experiments present car owners with two options: using an own car or using a shared car.
- Each of these two choices is decomposed into attributes displaying costs, access time to the car, CO2 emission of the automobile and an attribute reflecting a policy instrument on inner-city traffic.
- In addition, the effect of car owners' characteristics, their travel needs, environmental motivation and importance of cars are studied as well as impact from social norms.





# Triggering a switch in choices

- Experiments allow us to identify the factors triggering the switch from car ownership to car sharing.
  - Which attributes trigger a shift in their choices
  - Which combinations of attributes
  - What threshold levels of the attributes trigger the shift
- Attribute levels are derived from observed data offering a more realistic scenario to respondents.



- In addition to choice experiments, we collect individual characteristics, travel behavior as well as environmental concern and psychological ownership

**Triggering a switch  
in choices**

# Selected pilot results

- The predicted choice probabilities are between 64.7% and 66.3% for a car owner to select an own car
- The probability of choosing car sharing is reduced by 1.5% for each 10 000 SEK/month income increase of the car owner
- The probability of choosing car sharing is reduced by 0.2% for each one-year rise in age of the car owner



# Selected pilot results

- Costs of own car
  - CO2 emissions of own car
  - Additional congestion charge for privately owned cars
- no significant effect on triggering the average car owner to shift to car sharing
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- Access to carsharing
  - Lower the costs of car sharing
- no significant effect on triggering existing car owners to shift to car sharing



# Selected pilot results

- If the car owner is a woman, the probability is 5.4 % higher that she switches to carsharing compared to a man.
- A car owner that feels worried about climate change has on average 36.8% higher probability to switch to car sharing
- A car owner that expresses a higher positive attitude towards car ownership has 7.9% reduced probability to choose car sharing.



# Class 1 – Pro car-sharing car owners

- Class identified by a higher share of pro-car sharing decisions in total choices
- Its members opt for the alternative in 57.0% of all choice sets.
- This class has a higher probability to include younger car owners than other classes.
- Still, about 20% of members use the own car as most frequently utilized method of transport
- Higher costs for car sharing reduces demand
- Road taxes for privately owned cars matters for the utility for members of class 1.



# Class 3 – Pro own car owners

- Class identified by a higher share of own car decisions
- Favor own car in 81.5% of overall choice sets.
- Member of class 3 are what class 1 and 2 are not
  - Even more pro own car
  - Older
  - Less worried about CO2 emissions
- Costs of own car and car sharing does not significantly shift behavior
- CO2 emission of own car or electrification does not shift behavior
- Why?



## Class 2 – Intermediate car owners

- Respondents showing a higher concern for the environment but less importance to owning a car are more likely to belong to Class 2.
- Still prefer the own car in almost 2 of 3 choice sets meaning that other factors might influence their decision.
- Over 50% of members of Class 2 use their own car most frequently and, thus, are more affected by extra charges.
- Class 2 with members selecting the own car in 2 out of 3 decision situations reveals a strong aversion against road taxes





**Sell your car and  
switch to car sharing?**

Car owners answer the following questions each of them results in 4 model specifications:

1. Whether a car owner can imagine to sell his car and instead use car sharing in the next 6 months
2. Whether a car owner can imagine to sell his car and instead use car sharing before 2021
3. whether a car owner can think about selling or stop using his car in the next 6 months
4. whether a car owner can imagine selling his car before 2021.



## Sell your car and switch to car sharing?

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- If a car owner fears pollution impacts, the probability to sell the car by 2020 increases by 21.4%
- A 1-year-increase in the age of the car owner reduces the probability to sell the car within 6 months by 0.6%
- A 1-year-increase in the age of the car owner reduces the probability to switch to car sharing within 8 months by 0.8%
- If a car owner is a woman the probability that she will sell the car within 6 months decreases by 13.1%

# Effect of experience of other transport modes

If a car owner uses any form of public transport to work the probability that he will sell the car increases by 20-25%

If a car owner bicycles to work, the probability that he will

- sell the car by 2021 increases by 23.9%
- switch to car sharing by 2021 increases by 30.5%.
  
- Control for postal codes!





## Experience of pro-car-sharing decisions

- The larger number of pro-car sharing decisions in choice experiment, the larger probability that the car owner will choose car-sharing again

Mind set shift

# Overall conclusion

- Stated attitudes to car sharing not so negative among car owners in Gothenburg
- Still on average they choose their own car in 2 out of 3 choices
- Carsharing is a transformative behavior change
- Ownership to carsharing compared to non-ownership to carsharing?



# Transformative Behavioral Change



A process through which who we are – individually or collectively – is changed so deeply that the following are altered:



Identity - way of seeing and reflecting upon ourselves



Emotions - range of feelings and reactivity



Behavior – actions and norms



Embodiment - relationship and connectedness to and within our bodies and how we show up



Paradigms - overall perspective on the social group

# Policy recommendations

- Concern about climate change increases the probability by 36.1% that a car owner chooses car sharing
  - Education in public schools to increase environmental and climate awareness
  - Education about sharing goods in public schools
- Sufficiently high road taxes for privately owned cars



# Policy recommendations

- Increase availability and use of public transport and bicycling for commuting as complement for car sharing conclusive



# Policy recommendations

- Among the class of pro-ownership car owners
  - Availability and access to car sharing have no significant effect on the probability of car owners to shift to car sharing
  - Costs of own car and car sharing does not significantly shift choice
  - CO2 emission of own car or car sharing does not significantly shift the choice
  - Increasing road taxes reduce driving, increase public transport and may switch to some car sharing. There is no change in the probability to sell the car



# Policy recommendations

- Changing mindset by initially a larger number of pro-car sharing decisions to increase probability that the car owner chooses car-sharing again
  - Banning privately owned cars in city centers
  - Significantly higher road taxes
  - Free or subsidized trials of car sharing

