

Acceptance of car-reducing measures: observed factors and latent attitudes

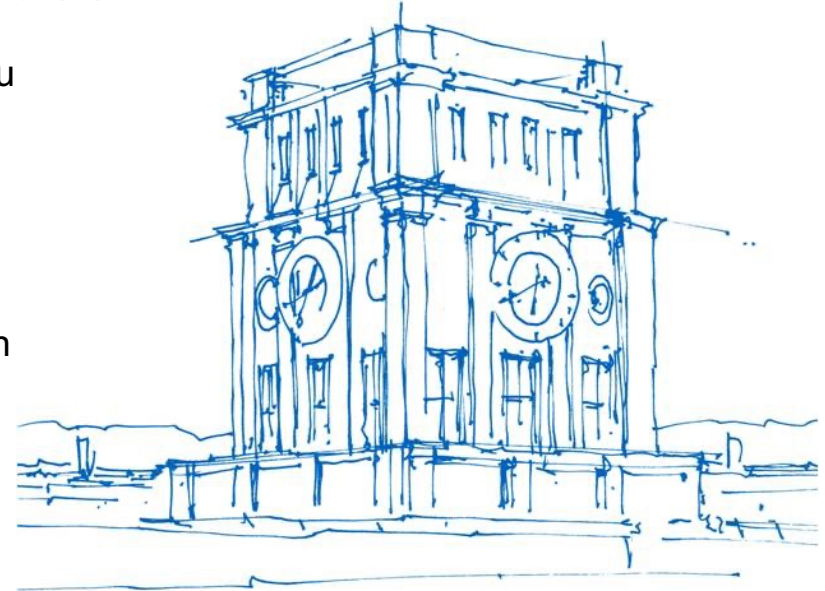
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Outline of the presentation

- Introduction and background
- Methodology
- Data collection and analysis
- Results and discussion
- Conclusions, limitations and policy implications

Introduction

Motivation

- By 2050, 70 % of the world's population will live in urban agglomerations (The World Bank, 2022).
- Due to spatial constraints, expanding the infrastructure is not a feasible alternative and does not solve the problem of congestion.
- Higher supply leads to higher demand in a vicious cycle.
- By-products of transportation (noise, emissions, use of space) have negative effects on health and well-being.



Neuhauser Straße in Munich before
1972 (Fritz Neuwirth, SZ-Photo)



Nowadays Germany's busiest shopping
mile (Florian Pellak, SZ-Photo)

Literature

- Advances in automotive technology **insufficient** in limiting environmental harm (Gössling et al., 2018).
- Travel demand management (TDM) aims to **reduce** number of trips or **redirect** to sustainable modes (Gärling et al., 2002).
- TDM measures distinguished into coercive “push” and non-coercive “pull” (Loukopoulos et al., 2005).
 - Coercive: actions to increase resistance in using private car.
 - Non-coercive: improving attractiveness of alternatives.
- Policymakers and public disagree:
 - Coercive: more effective, less acceptable (Eriksson et al., 2008).
 - Non-coercive: less effective, more acceptable (Gärling & Schuitema, 2007).
- The **acceptance** of those measures **varies** and is an important issue for their success (Banister, 2008).

Hypotheses and research question

Hypotheses

Respondents who are concerned about the environment tend to **support** car-reducing measures.

Respondents that support car ownership and use tend to **oppose** car-reducing measures.

Research question

“Which factors are associated with the acceptability of measures against private cars?”

Methodology

Car-reduced city quarters and measures

Mobility hubs



- Decreasing access and egress time to shared modes.
- Increasing availability of shared modes

Parking garages



- Increasing access and egress time to private cars
- Increasing parking cost for private cars

Neighbourhood mobility



- Decreasing walking distance
- Increasing parking search time
- Increasing parking cost for private cars

Active mobility



- Decreasing travel time of active modes
- Increasing travel time of motorised individual transport.

The stated preference survey

The survey consisted of three parts.

Established travel behaviour
and mobility instruments

Stated preference experiments

Beliefs and attitudes*
Sociodemographics

*psychometric indicators

If you could vote for the implementation of the measures discussed in the previous part, which one(s) would you choose?

 Check all that apply

- ☐ Extending the mobility hub network
- ☐ Removing on-street parking spots in favor of multipurpose parking garages
- ☐ Promoting neighborhood mobility by creating attractive public spaces
- ☐ Facilitating active mobility
- ☐ None of the above (everything should remain as it is)

The stated preference survey

The survey consisted of three parts.

Established travel behaviour
and mobility instruments

Stated preference experiments

Beliefs and attitudes*
Sociodemographics

*psychometric indicators

Statements regarding car ownership

Please indicate to which extent you agree or disagree with the following statements.

 Please reply to all statements.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
A car is a symbol of social status for me	☐	☐	☐	☐	☐
Having access to a car invokes to me a feeling of independence and freedom	☐	☐	☐	☐	☐
The brand/manufacturer is important to me when choosing to buy a car	☐	☐	☐	☐	☐
I deserve to own a good car because I have been successful in life	☐	☐	☐	☐	☐
I feel accomplished and fulfilled after buying a car	☐	☐	☐	☐	☐
A car is essential to my everyday mobility needs	☐	☐	☐	☐	☐

Statements regarding environmental concerns

Please indicate to which extent you agree or disagree with the following statements.

 Please reply to all statements.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The use of individual motorized transport threatens the environment	☐	☐	☐	☐	☐
It is my obligation to protect the environment through my transportation mode choice	☐	☐	☐	☐	☐
The government should increase the price of fuel in order to invest in public transport	☐	☐	☐	☐	☐
A way to reduce congestion is to ban cars from city centres	☐	☐	☐	☐	☐
I am concerned about the future of our planet	☐	☐	☐	☐	☐
I have already moved towards a more environmentally friendly lifestyle	☐	☐	☐	☐	☐

Data collection and analysis

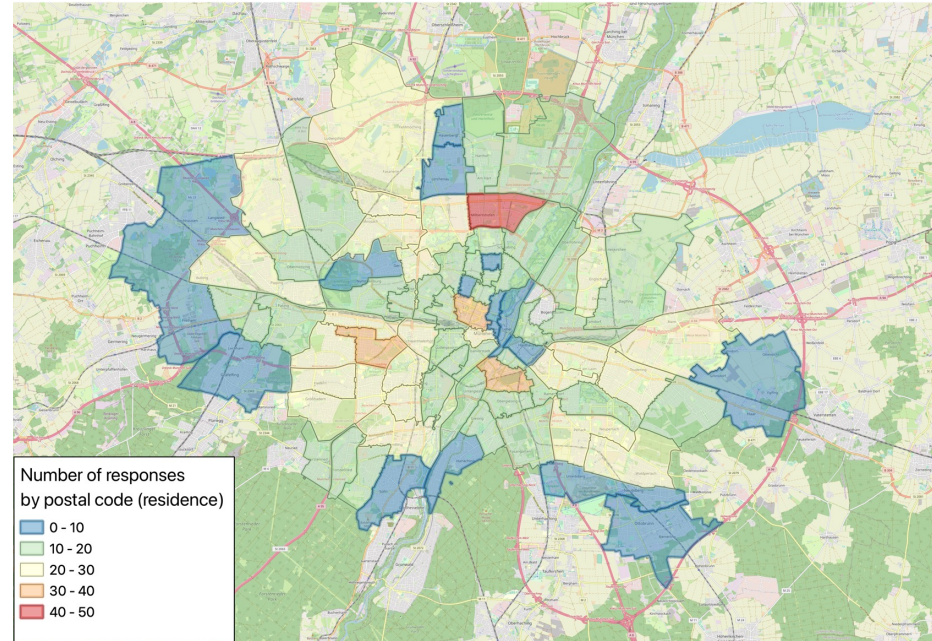
Data collection – stated preference survey

Sample size

- Removed underrepresented sociodemographic categories.
- $N=1497$

Representative sample

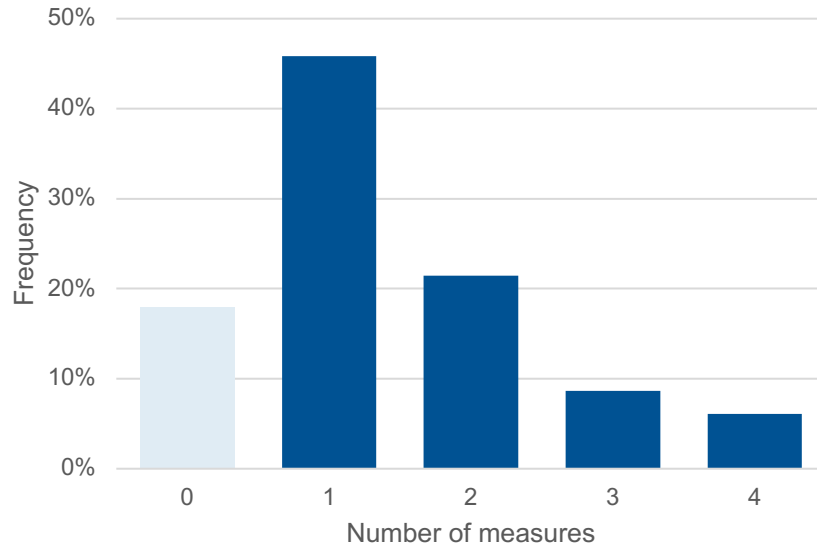
- Gender
- Age excluding ≤ 17
- Occupation
- Household size
- Driving license
- Car ownership



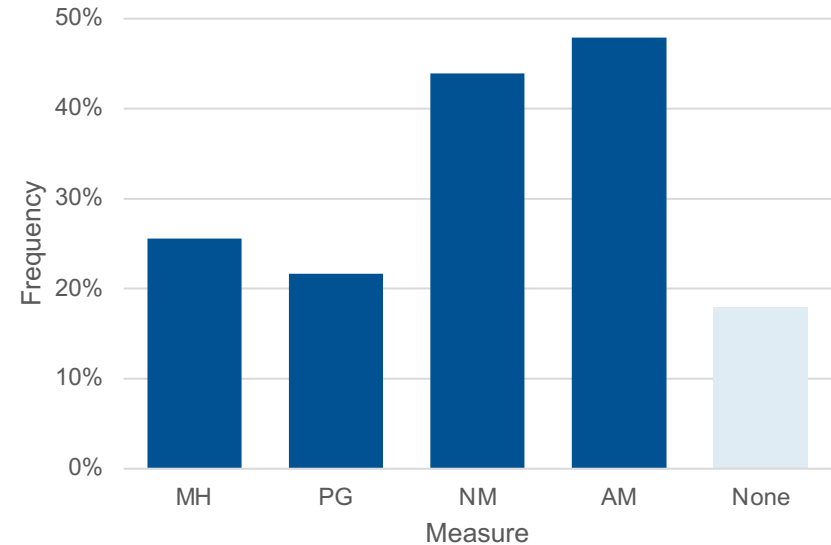
Spatial distribution of the sample in Munich (own elaboration)

Data analysis – selection of measures

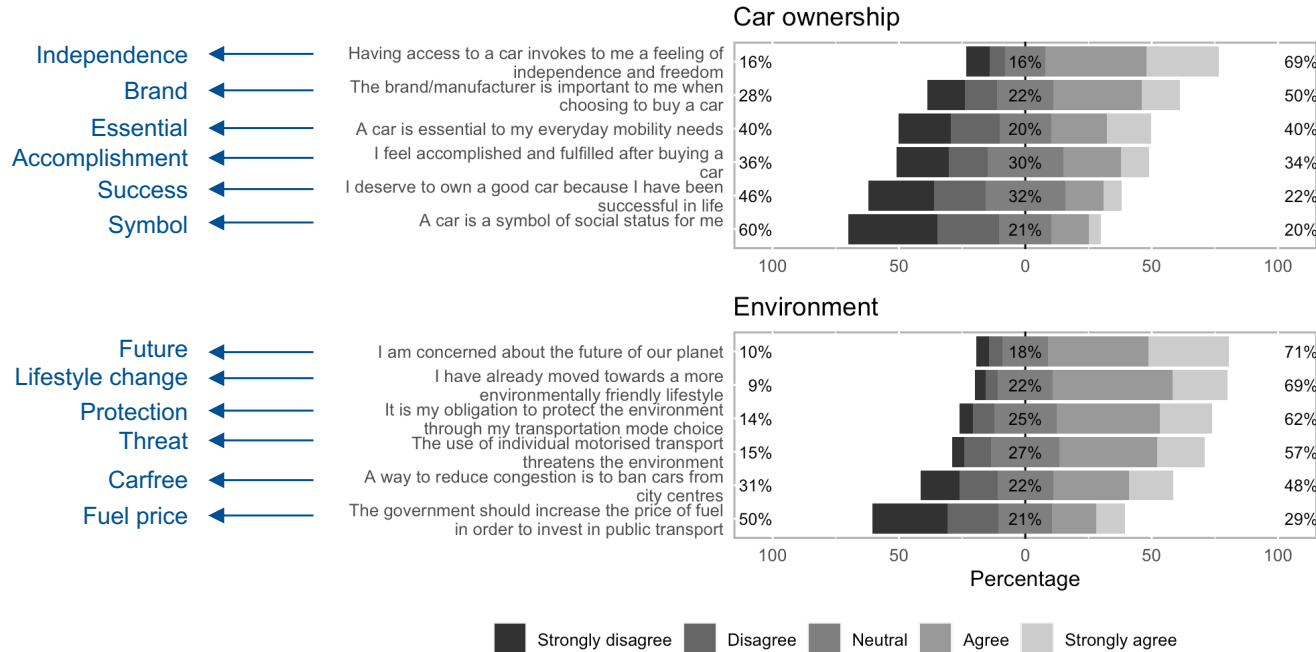
Number of measures selected



Which measures were selected



Responses to attitudinal questions





Exploratory factor analysis

Selection of factors:

- Percentage of explained variance hints at two or three factors.
- Loss of explained variance with two factors is low.

In the table:

- Factor loadings for attitudes towards car ownership and the environment (loadings ≤ 0.3 not presented, ≥ 0.7 highlighted).
- Interpretation of the factors:
 1. Pro-Environment
 2. Pro-Car

Variable	Factor 1	Factor 2
Symbol		0.718
Independence		0.605
Brand		0.686
Success		0.820
Accomplishment		0.828
Essential		0.531
Threat	0.741	
Protection	0.834	
Fuel Price	0.647	
Carfree	0.713	
Future	0.727	
Lifestyle change	0.673	
Summary statistics		
Proportional variance	0.269	0.251
Cumulative variance		0.520
χ^2 -statistic 644.12		
Factor interpretation	<i>Pro-Environment</i>	<i>Pro-Car</i>

Modelling the acceptance



Structural modelling results

Pro-Environment attitudes partially explain the acceptance of car-reducing measures.

Pro-Car attitudes not associated with the rejection of measures.

The model is **valid**:

- Comparative Fit (CFI) over 0.9.
- Tucker- Lewis (TLI) over 0.9.
- RMSE (0.08) acceptable.

Indicator	Estimate	Std. Error	t-stat.
Regressions			
Age ₃₀₋₅₉	-0.27	0.10	-2.85**
Education _{High School}	-0.18	0.09	-1.95 .
Education _{Other}	-0.72	0.27	-2.66**
Occupation _{Student}	0.55	0.29	1.93 .
Occupation _{Housewife/husband}	-0.53	0.25	-2.09**
Household income _{4000-7000 €/month}	0.21	0.10	2.12**
Home office _{2-5 days}	0.24	0.09	2.60**
Resident _{1-3 years}	0.60	0.28	2.13**
Subscription _{Public Transport}	0.28	0.11	2.60**
Driving License	0.35	0.14	2.49**
Car _{to Leisure}	-0.42	0.10	-4.26***
Public transport _{to work}	0.43	0.12	3.76***
Bike _{to Work}	0.47	0.17	2.82**
Bike _{to shopping}	0.27	0.14	1.94 .
Walk _{to Shopping}	0.22	0.10	2.15**
Car with companion _{to Work}	0.94	0.29	3.29**
Own Bike	0.22	0.10	2.13**
Use micromobility	0.70	0.12	5.76***
Pro-Environment	0.71	0.05	13.82***
Pro-Car	0.08	0.06	1.32
Covariances			
Pro-Environment ~ Pro-Car	-0.17	0.01	-12.57***
Summary statistics			
R ²	0.537		
χ ² -statistic	2838.958 with 279 df		
CFI	0.904		
TLI	0.973		
RMSEA	0.078, 90% CI [0.076, 0.081]		

Significance: 0 '****' 0.001 '***' 0.05 '.' 0.1



Main findings - sociodemographics

- **Age** Respondents between 30-59 years old disregarded the measures [busier].
- **Education** Basic education and vocational training associated with lower acceptance [out-of-office activities and freedom of mobility].
- **Occupation** Students accepted, housewives/husbands not accepted [shopping trips].
- **Income** Medium to high income (4000-7000 € monthly/household) higher acceptance [willingness to explore options, higher elasticity to changes in pricing].

Main findings – established travel behaviour

- **PT subscription** Users indicated their acceptance of the measures [measures aim to improve conditions].
- **Driving license** Accepted, caution as majority of respondents has license.
- **Active transportation** (walking, bike) associated positively with measures.
- **Car use for leisure trips** lower acceptance.
- **Commuting** with travel companion more likely to accept [lower sensitivity to changes in travel time].
- **Bike owners** accept measures, no meaningful association for owners of other vehicles (incl. cars).
- **Micromobility** users indicated agreement [measures aim to improve conditions for them].

Conclusions

Policy insights

Tool to target relevant **audiences** when policymakers make decisions:

- Maximise the acceptance of population groups that seemingly accepted the measures.

or...

- Nudge the groups that took a position against the measures.

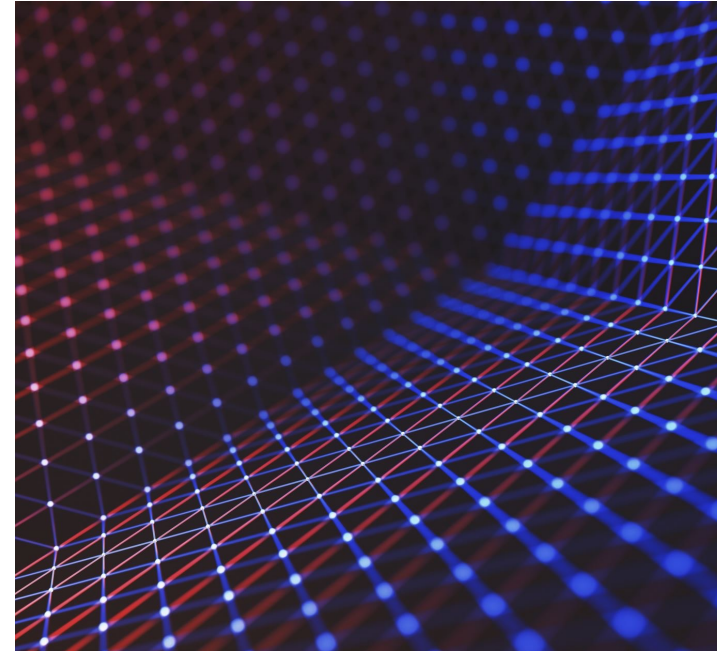
Limitations and future work

Limitations

- The proposed methodology does not account for interactions between variables.
- Responses in the study might be biased; goal of survey could be inferred from the context.

Future work

- Investigate the acceptance of each measure separately.
- Understand which factors influence each proposed measure.
- Integrate the latent constructs in a hybrid mode choice modelling context.
- Integrate the resulting models in a simulation environment to estimate the modal shift.



Conclusions



Pro-environmental attitudes affiliated with higher willingness to accept car-reducing measures.



Attitudes in favour of owning and using a car not significantly linked with acceptance / rejection of measures.



This work can be seen as guidance about the target groups of policies reducing car use and ownership.

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Thank you for your attention!

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<https://www.mos.ed.tum.de/en/vvs/home/>

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