

# **eHUBS - Smart Shared Green Mobility Hubs**

**Local Public Transport:  
Hubs and Micro-mobility**

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# Overview

- **Definition** - What are eHUBS?
- **Literature** - Who is likely to use eHUBS?  
What are potential target groups?
- **Study** - Attitudinal market segmentation
- **Barriers** - What are the perceived barriers that prevent people from using eHUBS?

# What are eHUBS?



# Example (concept)



<http://www.autodelen.net/project/e-hubs/>



# Example (concept)



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# Potential target groups?

- **Free-floating** car sharing (*DriveNow*) members tend to be young to middle-aged (25-44 years) males (Kopp et al., 2015)
- **Car sharing** demand is highest among young (20s-30s) residents (Kang et al., 2016)
- **Bike sharing** is used more frequently by young (18-34) and high-income population (Fishman, 2016; Fishman et al., 2015)

# Why attitudinal market segmentation?

- Hinkeldein et al., 2015

*Attitude-based approaches [...] could support the development of integrated mobility services by adding the view of a specific target group. A range of approaches exist which use different kinds of item batteries to measure mobility related attitudes with the aim to develop target group specific services.*

# Attitudinal market segmentation

- Work in progress
- Goal → Identify potential user groups based on **attitudes** towards shared mobility (SM), car use and the environment based on 20 pre-tested items
- Three steps:

Categorical PCA  
Cluster analysis  
Comparison





# Attitude examples

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I'd be interested in using eHUBS for non-work trips when they've become available in my city.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I prefer travelling the way I'm used to rather than using eHUBS.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shared mobility solutions like eHUBS are too complicated for me to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shared mobility options can't fulfil my mobility needs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

# Sample

- Representative Amsterdam sample

Age group	Population	%	Targeted sample	Achieved sample
18 – 24 age	87,168	12.52	63 (13%)	71 (14%)
25 – 34 age	174,953	25.13	126 (25%)	134 (27%)
35 – 44 age	124,051	17.82	89 (18%)	94 (19%)
45 – 54 age	114,812	16.49	82 (16%)	81 (16%)
55 – 64 age	92,579	13.30	66 (13%)	67 (13%)
65 – 74 age	62,216	8.93	45 (9%)	44 (9%)
75 or older	40,319	5.79	29 (6%)	12 (2%)
Total	696,098	100	500	503

# Categorical PCA



Positive attitude towards SM



Pro-environmental attitude



Barriers towards SM use

# Positive attitude ( $\alpha = .88$ , $R^2 = .23$ )

1. I'd be interested in using eHUBS for non-work trips when they've become available in my city.	Adoption intention for leisure	.85
2. I'd be interested in using eHUBS for commuting trips when they've become available in my city.	Adoption intention for commute	.83
3. I would enjoy trying out and using different electric vehicles from an eHUB.	Trialability	.82
4. Shared mobility options provide me with more flexibility in the way I travel.	Relative advantage	.78
5. I am confident that, if I wanted to, I could use eHUBS without problems.	Complexity	.67
6. I'm often among the first people to experiment with new technologies.	Affinity for technology	.60
7. I feel confident to ride an electric bicycle.	PBC e-bike	.58

# Pro-env attitude ( $\alpha = .88$ , $R^2 = .20$ )

8. For the sake of the environment, everyone should reduce how much they use cars.	Pro car use reduction	.79
9. I feel a moral obligation to reduce my emissions of greenhouse gases.	Personal norm	.77
10. People who drive cars that are better for the environment should pay less to use the roads.	Green incentive	.77
11. Congestion, air pollution and noise from road traffic is a real problem in my city.	Perceived severity of environmental issues	.76
12. People around me find it important to reduce emissions of greenhouse gases.	Perceived subjective norm	.70
13. Almost everyone around me owns a private car.	Perceived social norm	.52



# Perceived barriers ( $\alpha = .83$ , $R^2 = .16$ )

14. Shared mobility solutions like eHUBS are too complicated for me to use.	Complexity	.74
15. I do not feel confident to use an electric car.	PBC e-car	.69
16. People should be allowed to use their cars as much as they like, even if it causes damage to the environment.	Contra car use reduction	.68
17. Shared mobility options can't fulfil my mobility needs.	Perceived compatibility	.62
18. There is no point in using shared mobility options if you already own a car.	Added value	.60
19. I prefer travelling the way I'm used to rather than using eHUBS.	Habit	.59
20. I'd rather wait for other people to try eHUBS before I use them.	Delayed adoption intention	.46

# Clustering (Ward's method)

- Based on the three attitudinal factors



# K-means cluster analysis

- Testing two to six cluster solutions

Number of clusters (k)	N cases in Cluster 1	N cases in Cluster 2	N cases in Cluster 3	N cases in Cluster 4	N cases in Cluster 5	N cases in Cluster 6
2	483	22				
3	439	48	18			
4	346	97	44	18		
5	44	2	16	346	97	
6	39	338	96	18	12	2

- Four clusters = best solution

# Comparing clusters

Clusters were compared based on:

- Scores on attitudinal factors
- Demographic variables
- Traveller identity (e.g., cyclist)
- Current SM use and intentions
- Perceived barriers to SM use

# Example: SM use and intentions

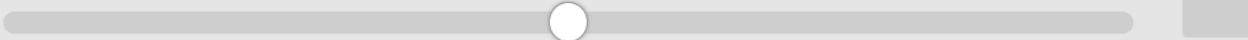
9. How likely would you be to use an **e-bike** from an eHUB in the future if it were available in your city?

0 - Extremely unlikely 100 - Extremely likely



10. How likely would you be to use an **electric car** from an eHUB in the future if it were available in your city?

0 - Extremely unlikely 100 - Extremely likely



11. Do you use any **publicly** shared vehicles on a regular basis? (tick all that apply)

- ☐ I don't use any shared vehicles
- ☐ Shared bike
- ☐ Shared car
- ☐ E-scooters
- ☐ Other (please specify)



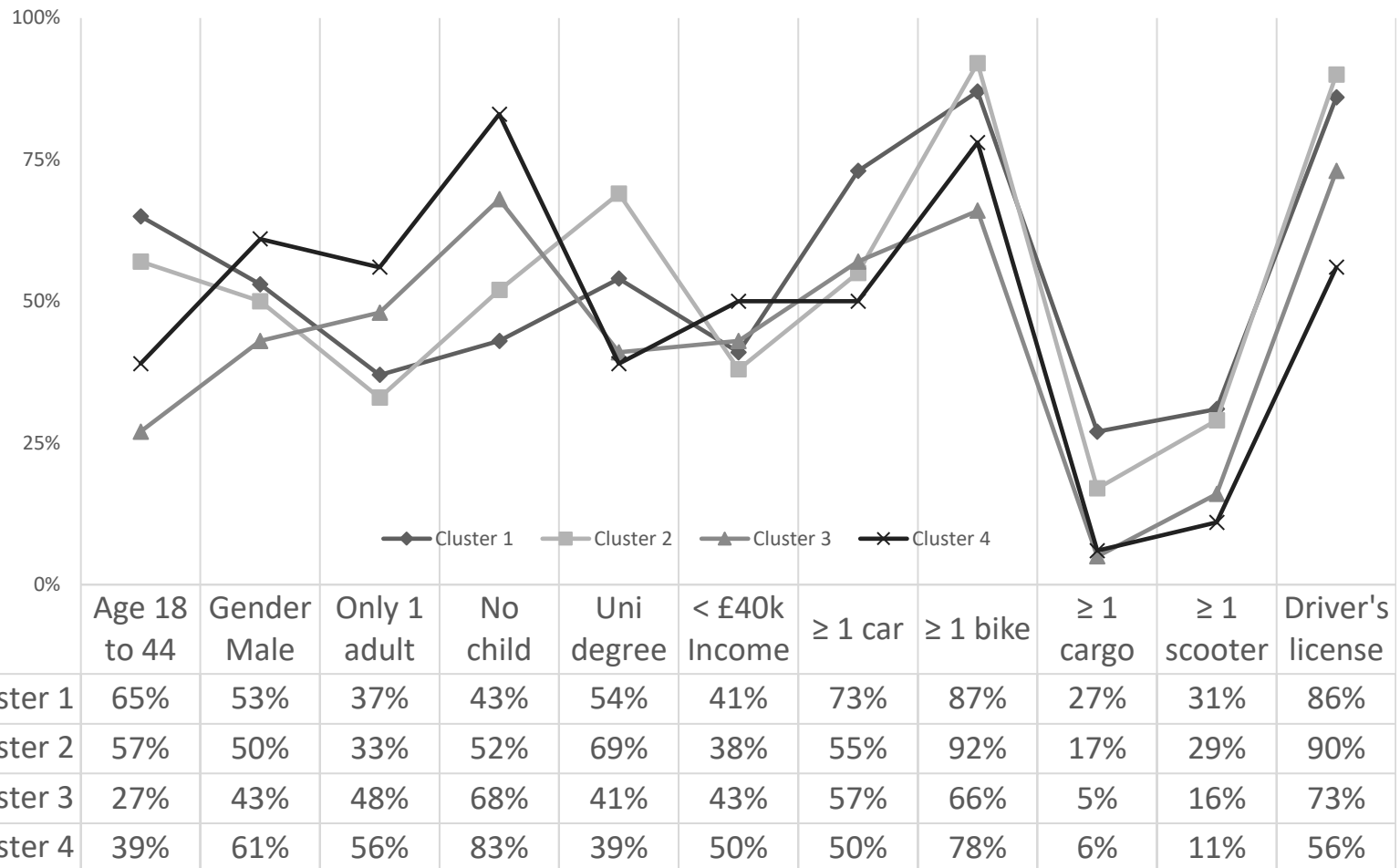
# How do clusters differ?

- Tendencies based on mean object scores

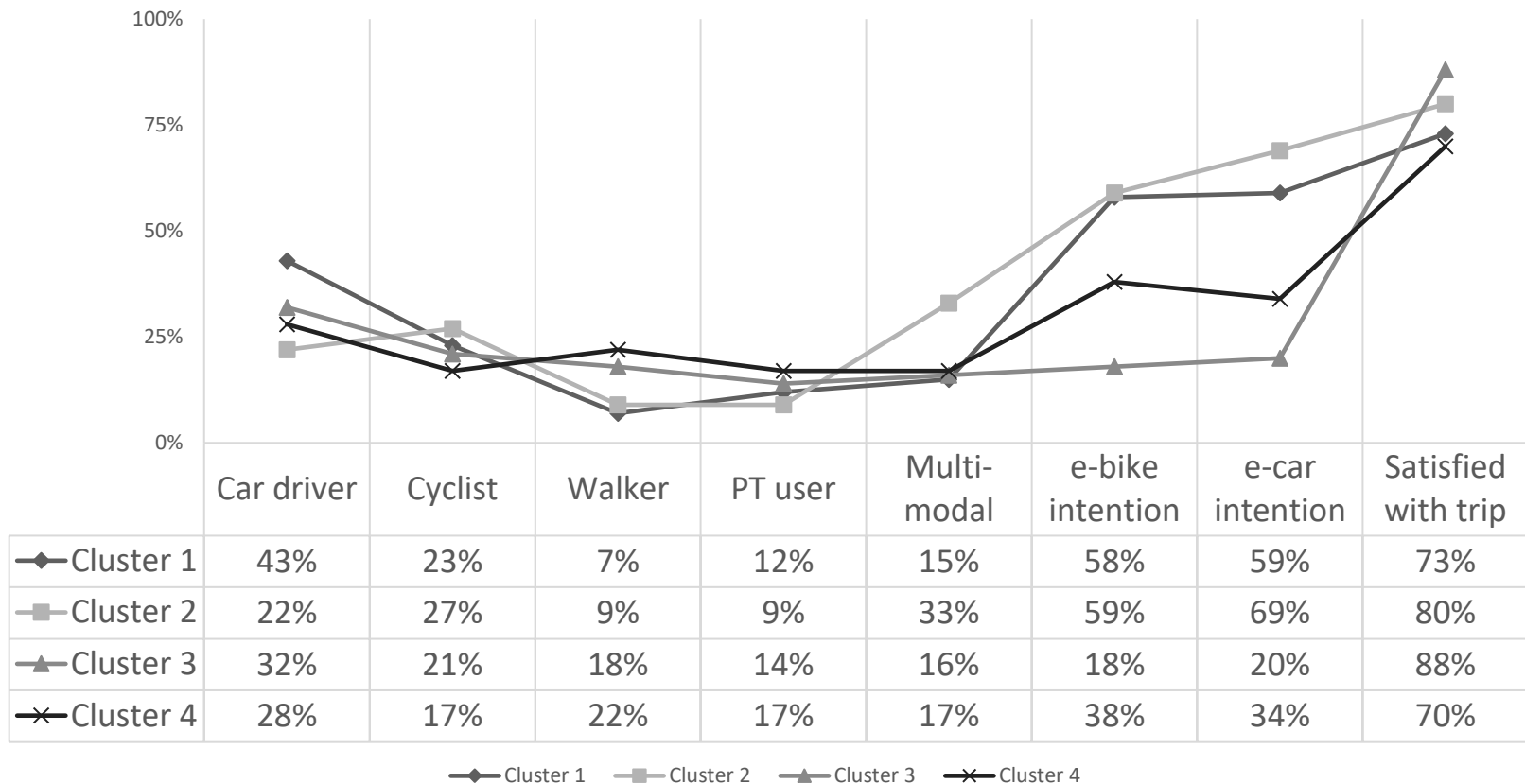
Components	1	2	3	4
Positive attitude towards shared mobility	+	+	--	-
Pro-environmental attitude	0	+	+	--
Barriers towards shared mobility use	+	-	0	-
Number of respondents (N)	346	97	44	18
% of sample	69%	19%	9%	3%

++ > 2, + (0.1, 2), 0 (-.1, .1), - (-.1, -2), -- < -2

# How do clusters differ?



# How do clusters differ?



# Cluster 1 ( $n = 346$ )



- Young to middle aged adults (65% are 18 to 44)
- Lowest share of households with no children (43%)
- Highest share of households with **at least** one car available (73%)
- Greatest proportion of respondents who identify as a **car driver** (43%)
- Show **some** interest in the use of either e-bikes (58/100) or e-cars (59/100) from an eHUB

# Cluster 2 ( $n = 97$ )



- Similar to Cluster 1 in terms of age, gender, income
- Highest proportion of respondents with a **university degree** (69%)
- Highest share of households with at least one bicycle available (92%)
- Highest proportion of respondents identifying either as **multi-modal users** (33%) or **cyclists** (27%)
- Show interest in using e-bikes (59/100), but an even stronger interest to use e-cars (69/100)

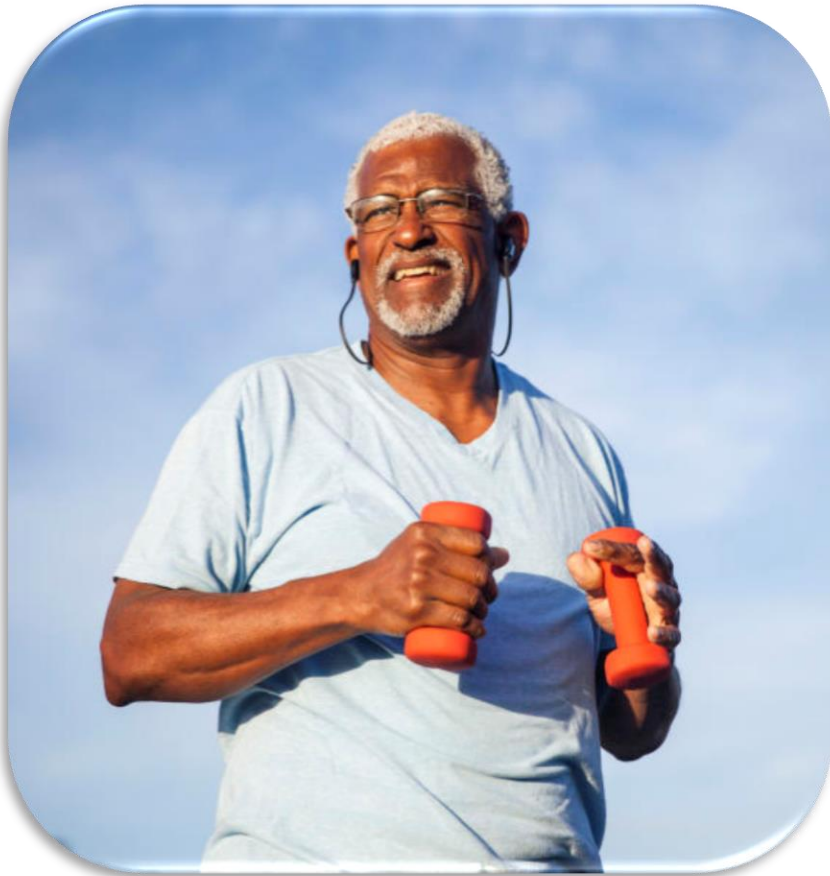


# Cluster 3 ( $n = 44$ )



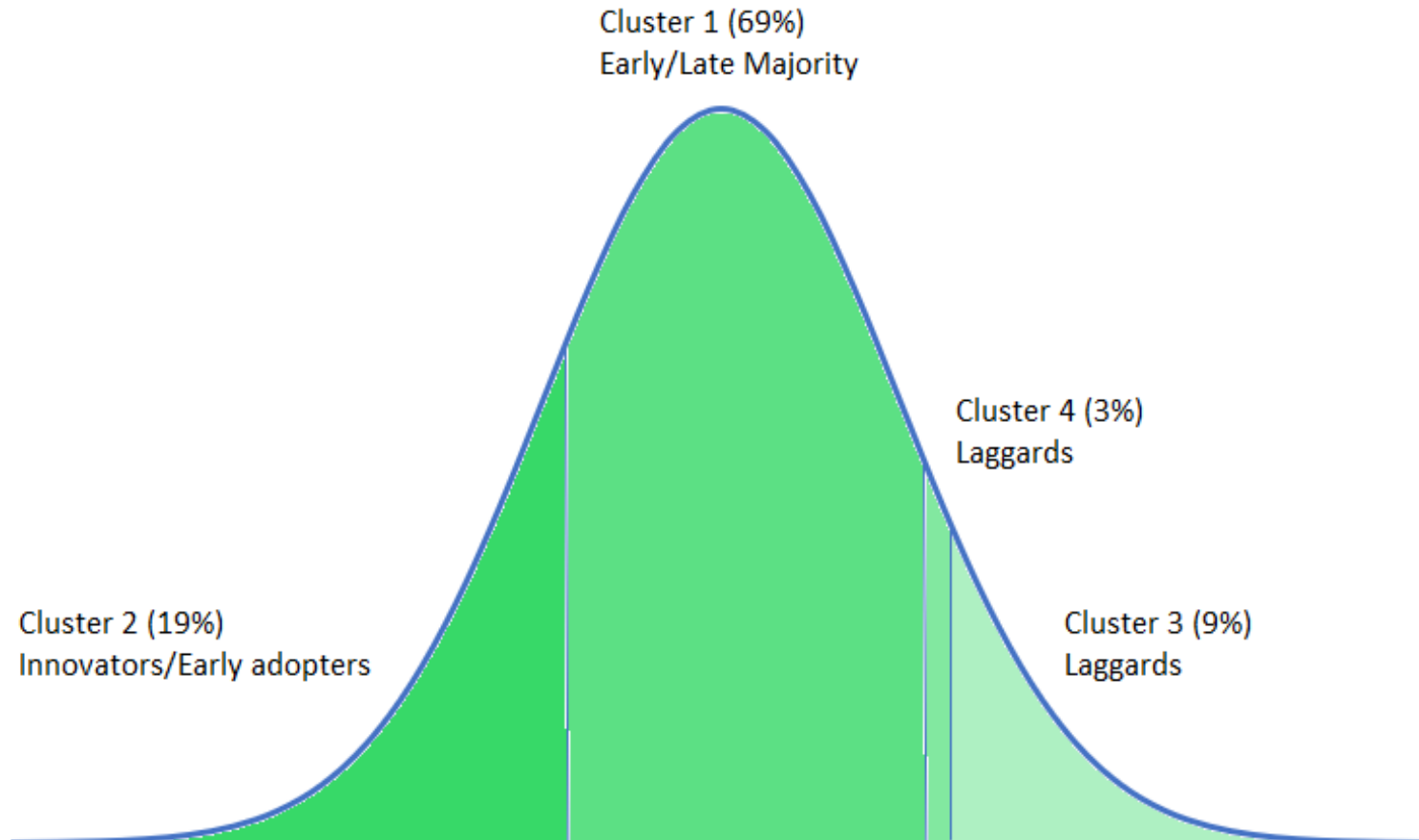
- Older (only 27% are 18 to 44)
- More likely to be **female** (57%) and less likely to have university level education (41%)
- Tend to live in a single person household (48%) with no children (68%)
- Least likely to have a bicycle available (66%) but **most satisfied** with regular trip (88/100)
- **Least interest** in using either e-bikes (18/100) or e-cars (20/100) from an eHUB

# Cluster 4 ( $n = 18$ )



- Similar to Cluster 3 in terms of age and education
- Majority is **male** (61%) and tends to live in a single person household (56%) with no children (83%)
- Least likely to hold a driver's license (56%)
- Highest proportion of members identifying themselves as either **Walkers** (22%) or **PT users** (17%)
- Little interest in using either e-bikes (38/100) or e-cars (34/100) from an eHUB in the future

# Diffusion of Innovation Theory (Roger, 1962)



# SM use and perceived barriers

Shared mobility use and perceived barriers	Cluster 1 (n = 346)	Cluster 2 (n = 97)	Cluster 3 (n = 44)	Cluster 4 (n = 18)
I don't use any shared vehicles	63%	53%	96%	89%
Use shared bikes on a regular basis	19%	16%	2%	6%
Use shared cars on a regular basis	20%	30%	5%	11%
Use e-scooters on a regular basis	7%	11%	2%	-
I am satisfied with my own car/bike	34%	26%	68%	28%
I prefer to use existing public transport	17%	10%	34%	6%
I do not see the added value of shared mobility	8%	4%	23%	17%
I'm afraid that there is no shared vehicle available when I need it	15%	14%	23%	6%
It is too expensive to rent vehicles	16%	19%	16%	11%
The shared vehicle location is too far from me	10%	11%	11%	17%
I don't feel safe to use shared vehicles	6%	3%	11%	11%
It is hard to reserve and pick up vehicles	8%	7%	11%	6%
I cannot leave the vehicles where I want	11%	7%	9%	-
I'm concerned with my travel data/privacy	6%	8%	11%	-
I haven't heard of it/I'm not aware of its existence	6%	1%	2%	6%
Shared vehicles are badly maintained/dirty	5%	2%	5%	6%
It is hard to register and pay for vehicles	5%	3%	2%	-
Other barriers	3%	2%	9%	11%



# Three major take-aways

- Those most interested in shared mobility options are **already** multi-modal/cyclists
- **BUT** there is a huge majority of potential early/late adopters who **are** interested
- To speed up adoption, **perceived barriers/concerns** need to be addressed



# References

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# Thank you!



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