

FABULOS

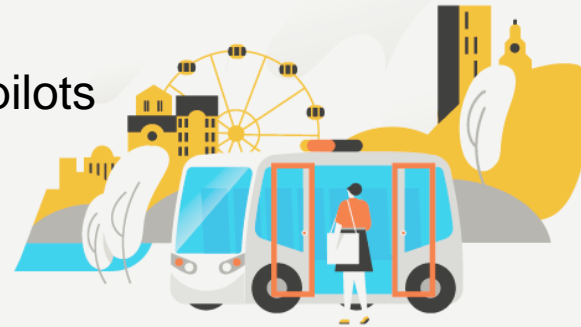
User acceptance and passenger satisfaction surveys

Forum Virium Helsinki



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- Non-user surveys
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- Background: Key results from other pilots



FABULOS pilot passenger surveys



Meet the pilot cities



Helsinki

Gacha robot bus

The Pasila route ran on a dedicated bus lane around a large block consisting of offices and housing, together with several public services and authorities.



Tallinn

ISEAUTO robot bus

Route ran from Tallinn Ülemiste City E - Estonia Briefing Center to the International Airport and from there to a Ülemiste shopping center.



Gjesdal

NAVYA robot buses

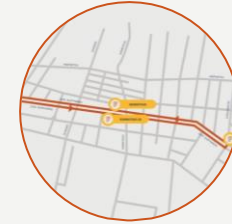
Pilot route ran between residential detached house area located on top of a hill and a commercial area located in a valley, serving local shoppers and school kids.



Helmond

NAVYA robot bus

Connected Brandevoort railway station and the Automotive Campus. The route was characterised by the presence of a school, roundabouts, a cycle street, different types of roads and several demanding intersections.

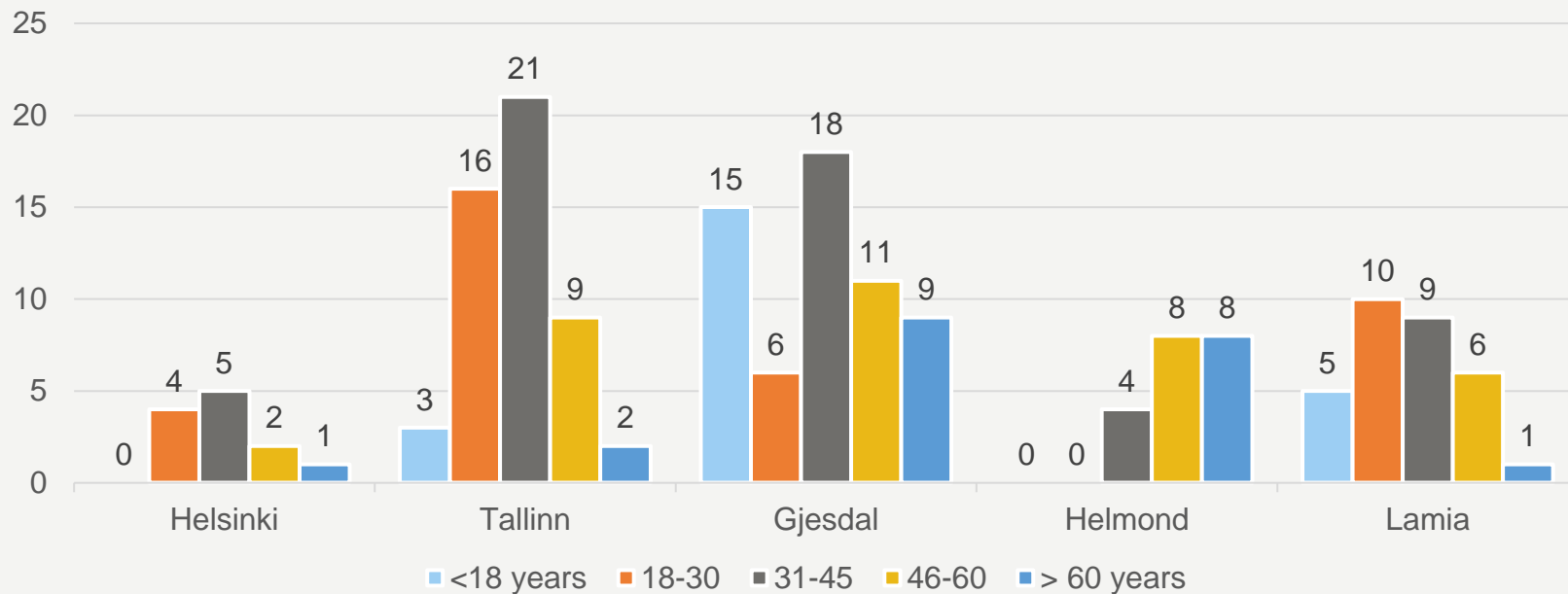


Lamia

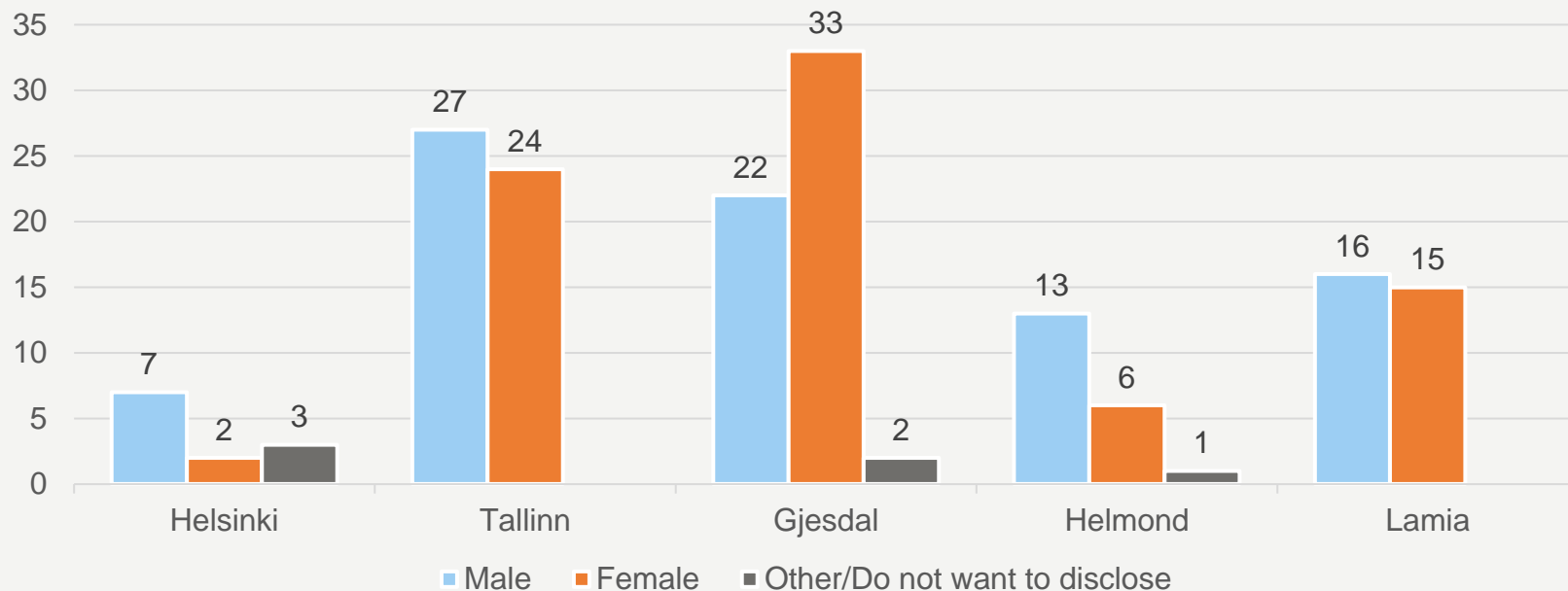
ISEAUTO robot bus

Pilot route was 3,2 km long and included a dedicated bus lane with a speed limit of 40km/h. The route was adjacent to busy pedestrian and bicycle routes. The pilot zone included several key city points of interest.

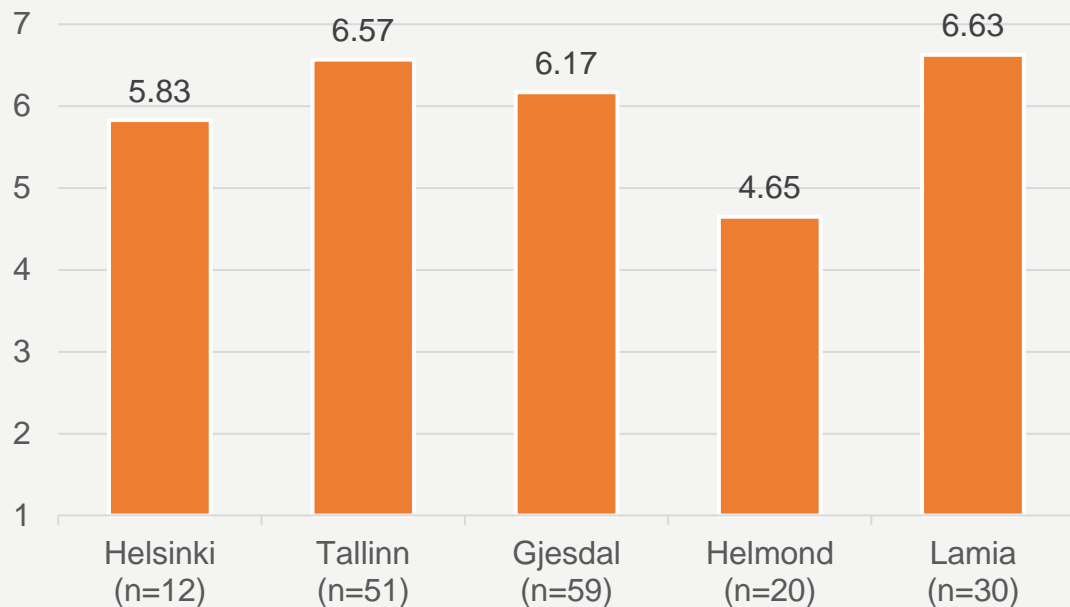
Pilots reached different groups, local demographics create differences (1/2)



Pilots reached different groups, local demographics create differences (2/2)

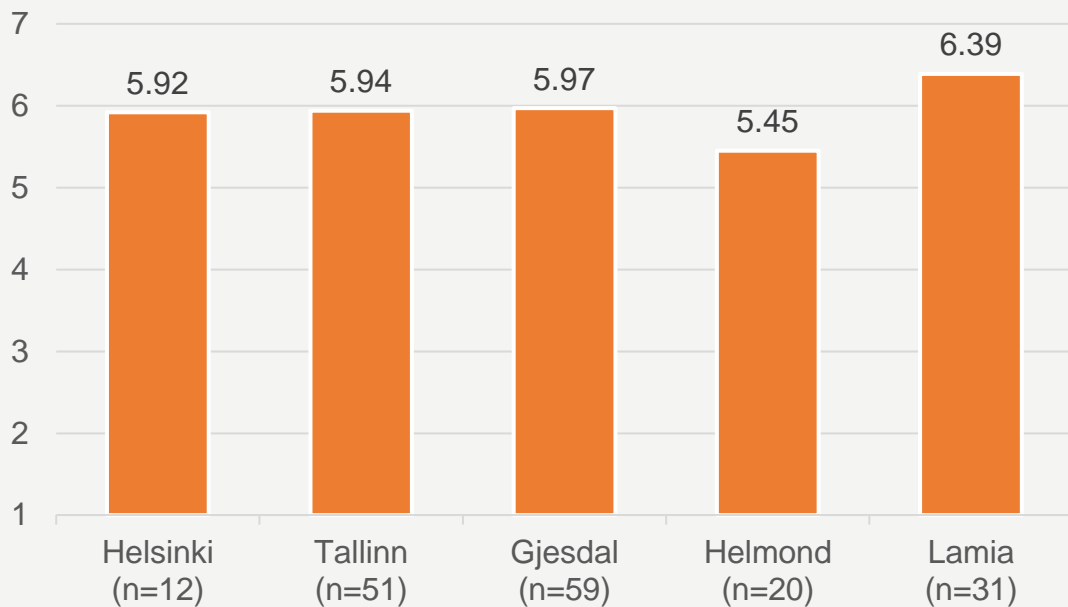


Passengers in Helmond were least satisfied with the **overall experience**



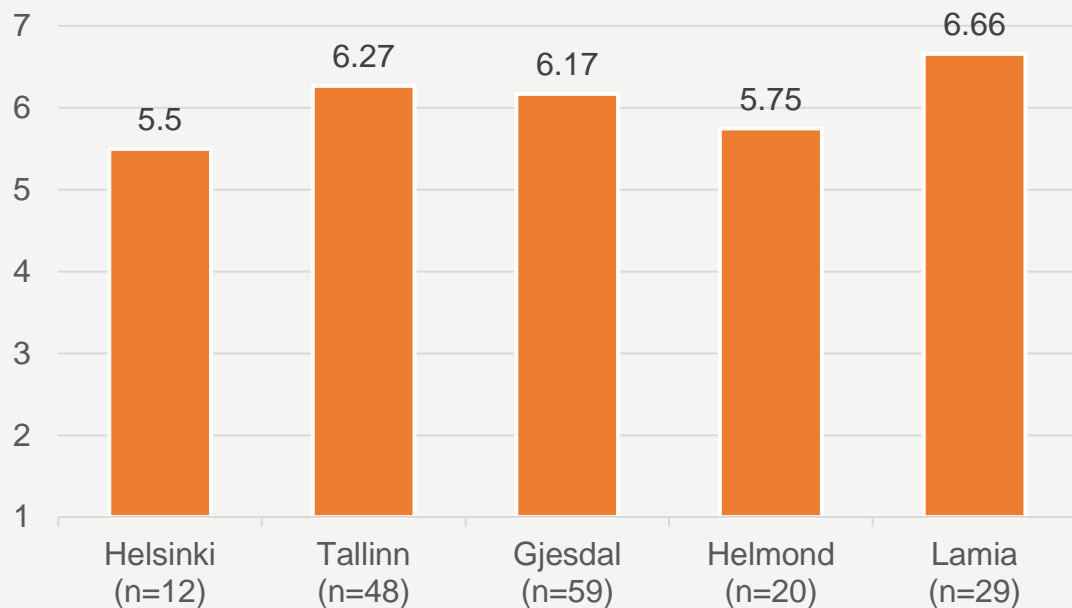
- Sample in Helmond is small, which may bias the results. Based on the open question responses, passengers in Helmond were not satisfied with the speed of the bus and commented the need to further develop the self-driving technology

Traffic safety was scored mainly positively in all pilot cities



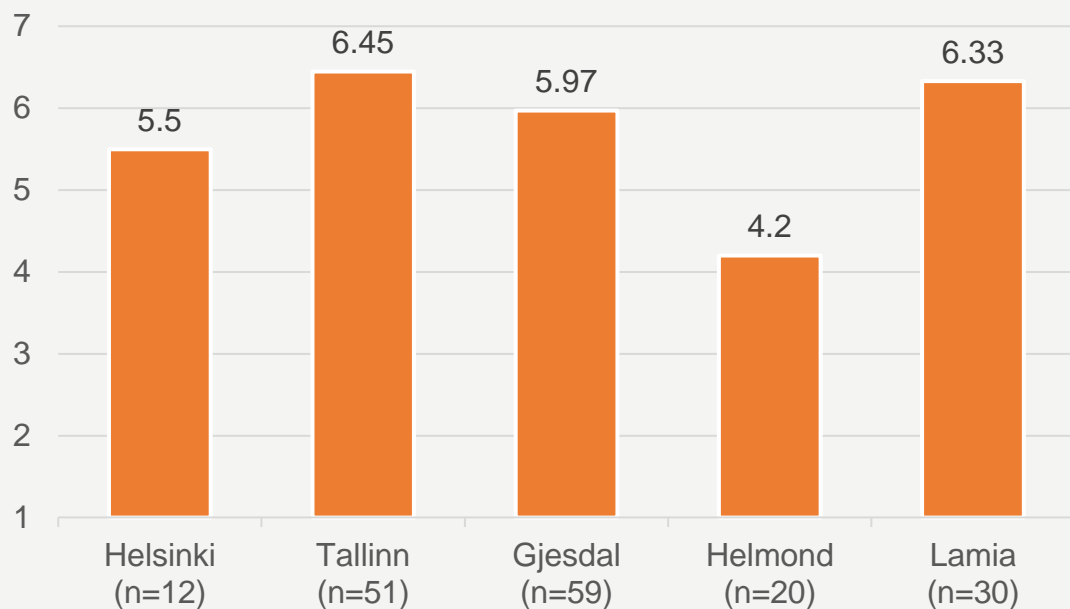
- In Helsinki, the score for personal safety was the lowest. No clear reason could be identified from open responses. In the **non-user** survey, many respondents in the Finnish survey commented, that especially during other passengers may cause lack of personal safety.

Personal safety was also regarded good – in pilots there were operators on board



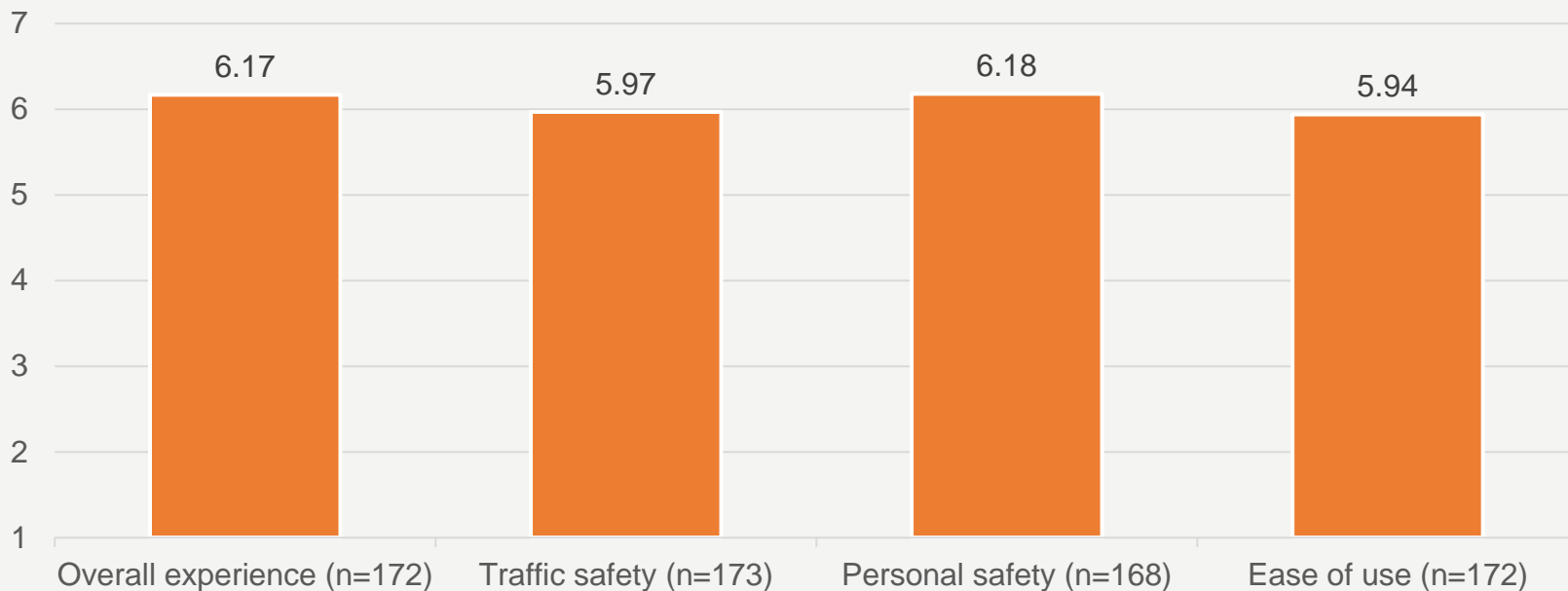
- In Helsinki, the score for personal safety was the lowest. No clear reason could be identified from open responses. In the **non-user** survey, many respondents in the Finnish survey commented, that especially during other passengers may cause lack of personal safety.

Passengers in Helmond did not rate ease of use as positively as others

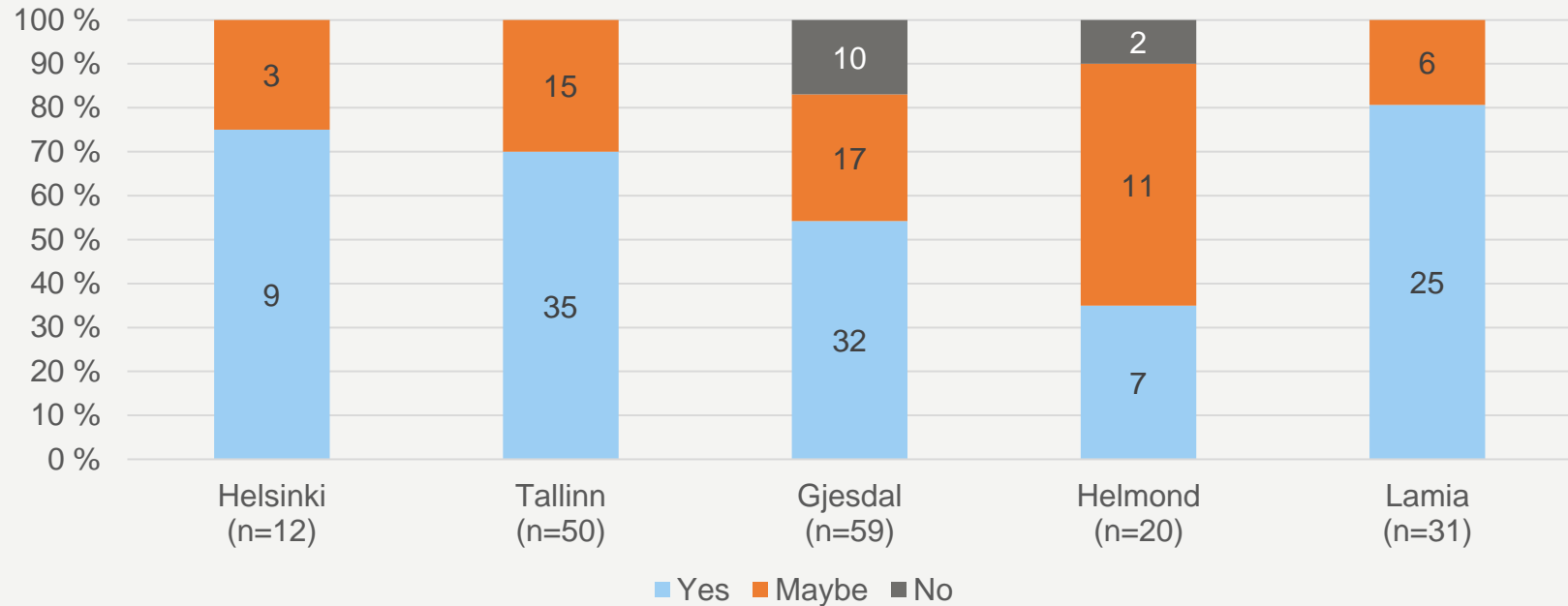


- Ease of use was rated much lower in Helmond than in other cities. This could be due to several factors, such as the route or the robot bus used. Open responses did not reveal the reasons behind.
- The score was also lower in Helsinki, where disabled passengers tested the bus, which may have reduced the score slightly.

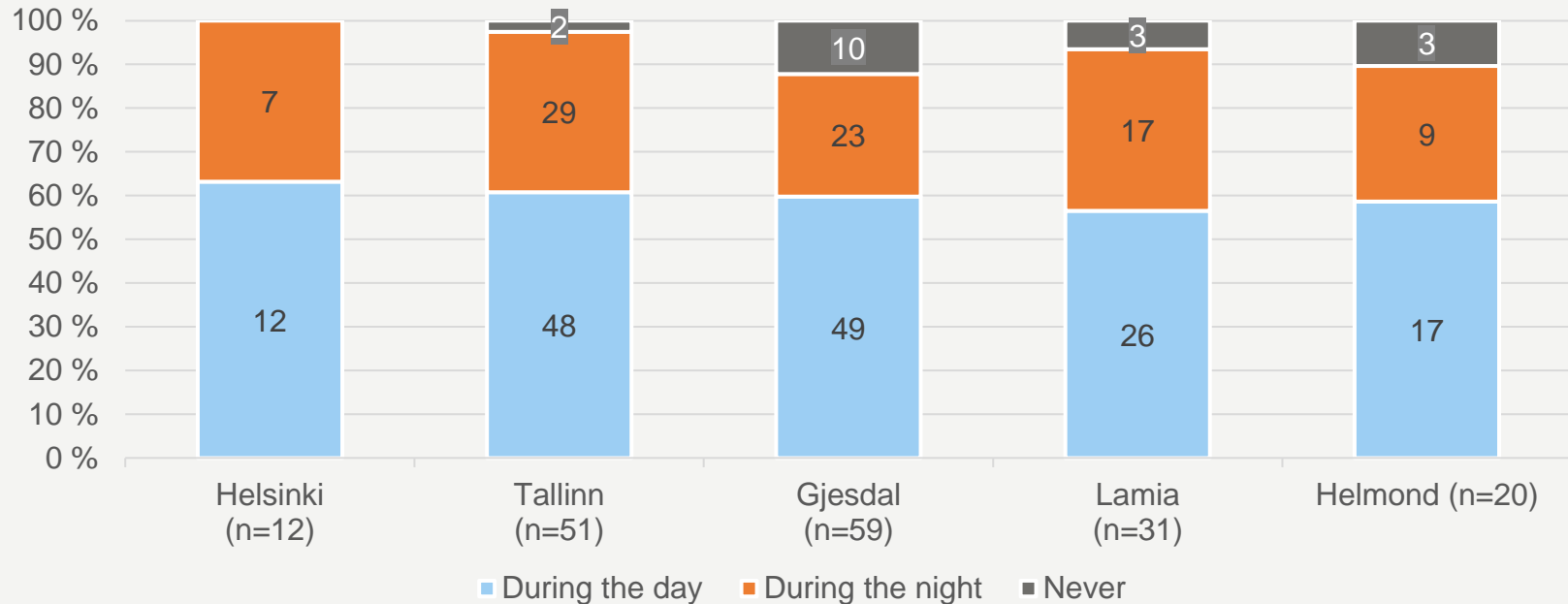
On average, overall experience and personal safety were rated more positive, but difference is small



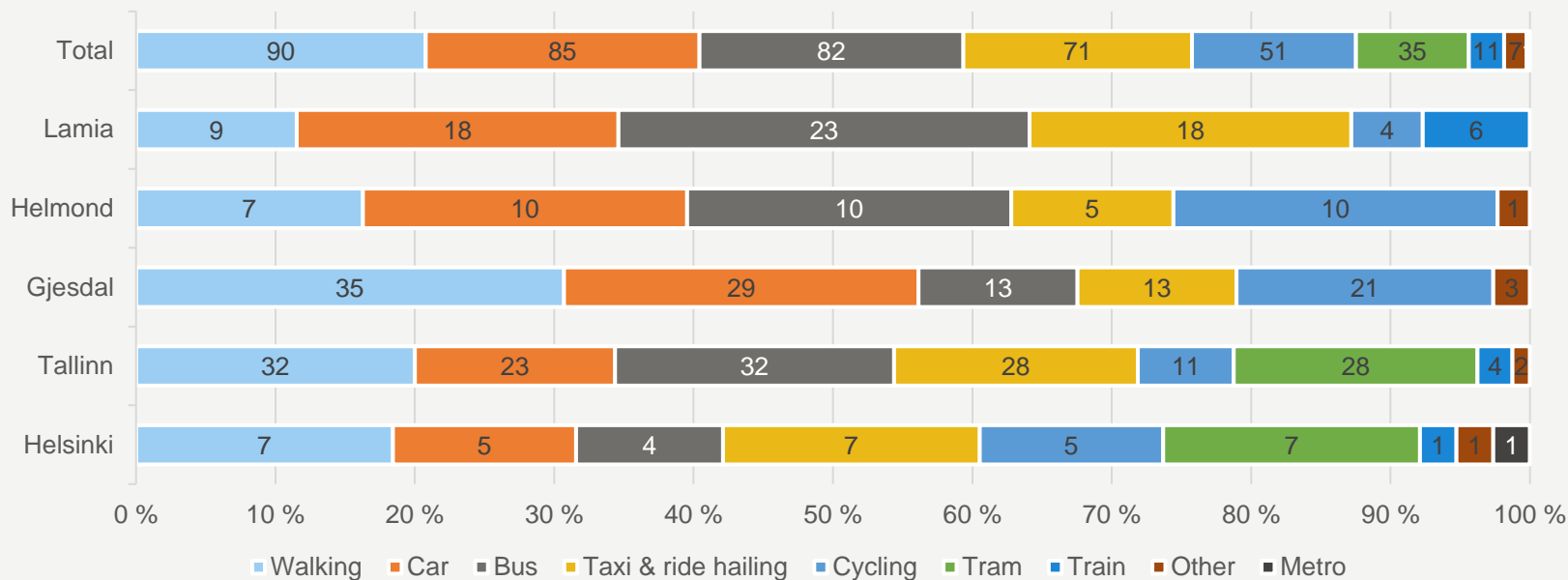
Many could use robot buses for daily travel, some differences between cities



Most passengers would use a robot bus during the day, night time use is less likely

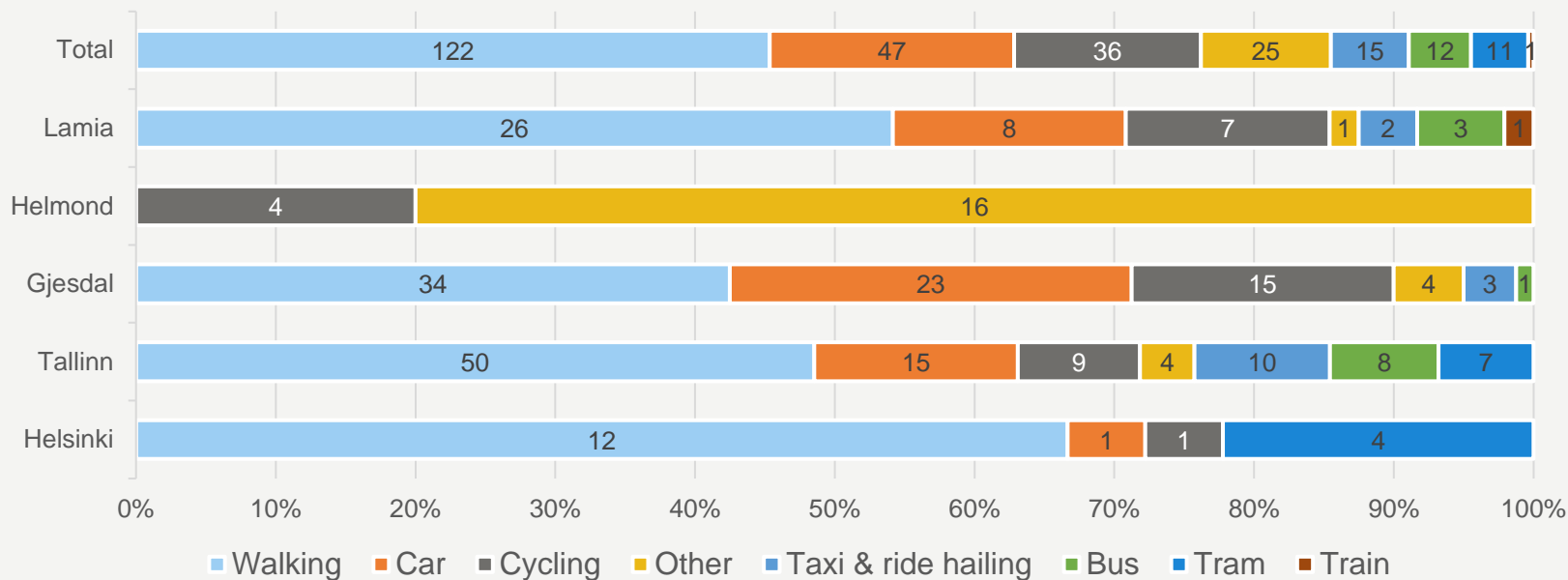


Walking, bus, car & taxi could be replaced by robot buses according to participants



Note: Not all alternatives were available in all cities and were excluded in the survey form.

Robot buses mainly replaced walking in the pilot routes



Note: Not all alternatives were available in all cities and were excluded in the survey form. Helmond had different choices, Other = "Not typically travelling here"

Questions and comments (Helsinki)

Dynamic routing would be nice

Difficult to use with wheelchair, too wide gap between the stop and bus

It is difficult to observe the elevated rear floor, needs better markings

Seats need head rests if the speed is increased

Larger route signs and clear markings for visually impaired passengers

Needs a button to notify when a disabled passenger boards the bus

The bus brakes very rapidly if it sees obstacles, which decreases comfort

App doesn't support text-to-speech for visually impaired

Softer seats and suspension would make the ride more comfortable

Questions and comments (Tallinn)

Dynamic routing or on-demand service would be nice.

More technical capability needed to independently participate in traffic.

The bus drives too slow and brakes too hard!

Seats could face travel direction.

Amazing experience, thank you!

Ventilation and suspension need improvements.

More routes in Tallinn and bigger buses!

Schedules were hard to find.

Very good for this development stage, very promising!

Questions and comments (Gjesdal)

Great for elderly with limited mobility, helps with hills.

This is just great!

Does it work also when it is slippery?

The bus is too slow.

Emergency stops are too frequent.

Braking is too strong, kids can hit their head.

Would use it without a operator if it was proven to be safe.

Wider and permanent service in the city would be nice!

Driver often needed, especially if there would be an accident.

Questions and comments (Lamia)

Braking could be improved.

The vehicle should be larger to accommodate more passengers.

I would use it often!

I wish there would be music onboard!

New and longer routes would be nice.

How the bus responds to different situations is not known by the passengers.

Questions and comments (Helmond)

The bus should be faster,
less cyclist would try to
pass it!

A lot of technological
development is needed,
but this is the future

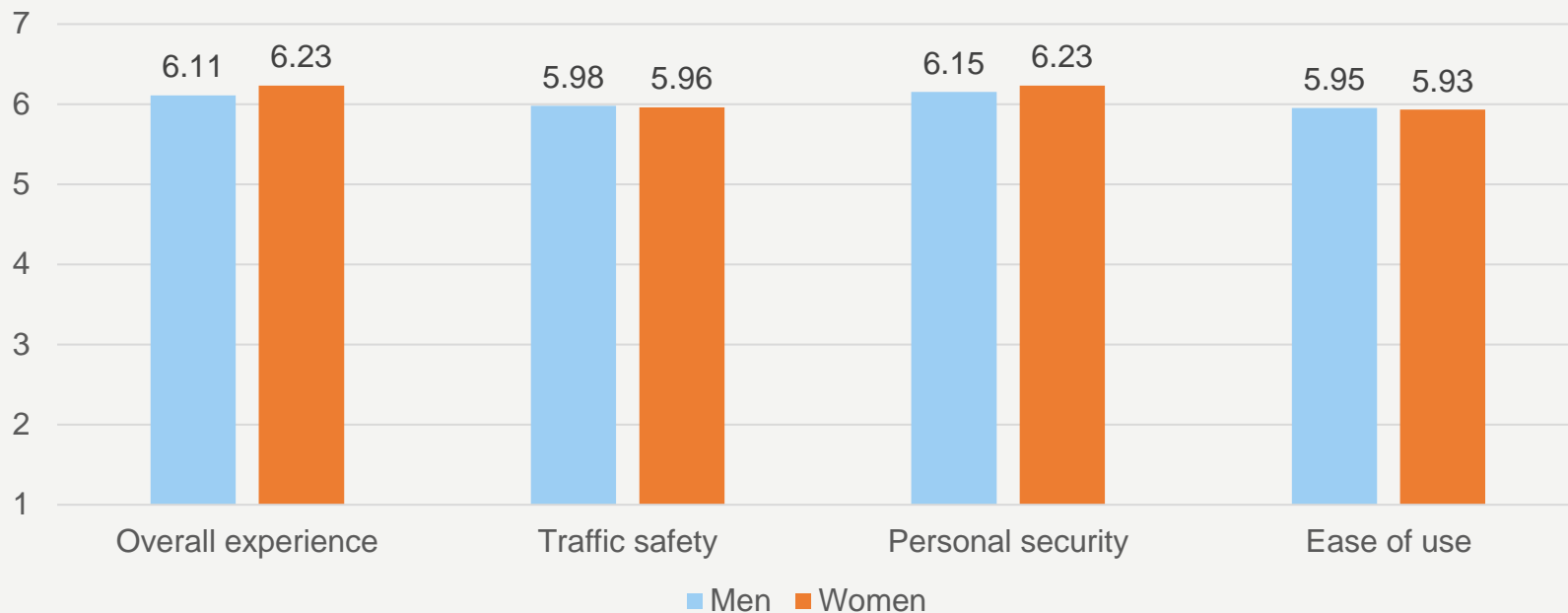
The driver is still needed
and technological
development is slow.

I wish the seats were
more comfortable!

Hacking will be a problem.

The practicality depends
on your origin and
destination.

The difference in the ratings between women and men is minimal



Conclusions from pilot surveys

- Attitudes towards robot buses were least positive in Helmond and Helsinki, but overall the robot buses were rated positively
- Passengers would use robot buses during the day
- Robot buses could mainly replace other buses, walking, car and taxi. In the pilots they replaced mainly walking
- Passengers wish improvements in ride comfort (suspensions, seats, speed and braking) and hoped for more routes.
- No major differences in ratings between men and women



Non-user survey results

February 2021

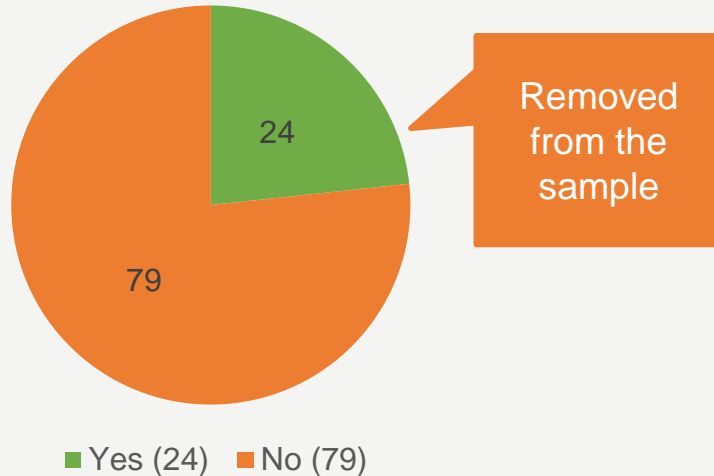


Non-user survey background

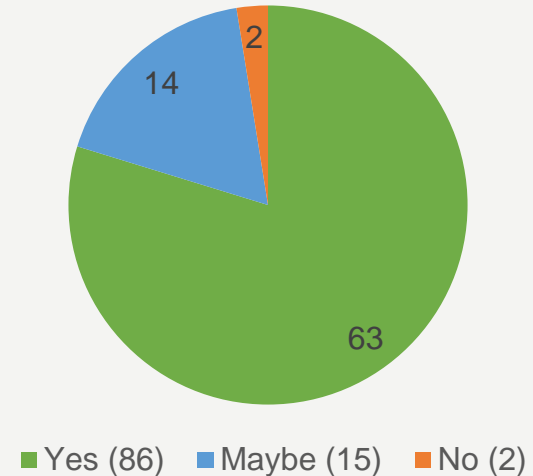
- The purpose of the non-user survey was to understand acceptance in public which have not yet tried a robot bus
- While aimed at non-users, the survey reached also some respondents who had some experience travelling on board a robot bus, some potentially in FABULOS and some in other pilots around Europe
- 103 responses were received. 24 responses indicated prior experience with robot buses and were excluded, leaving 79 responses for analysis.

Most respondents had no experience with robot buses – still willing to try!

Have you been on board a robot bus?
(n=103)

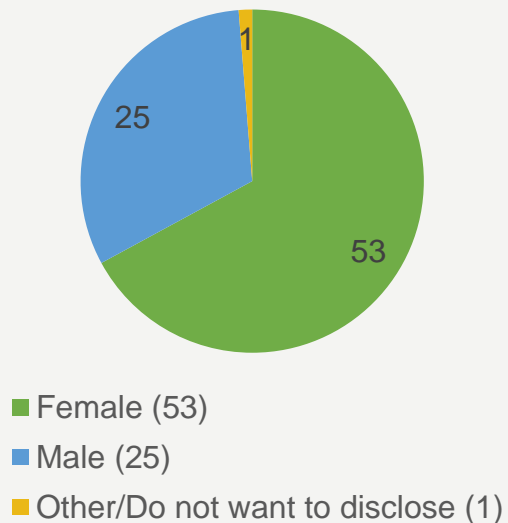


If available, would you be willing to test a robot bus? (n=79)

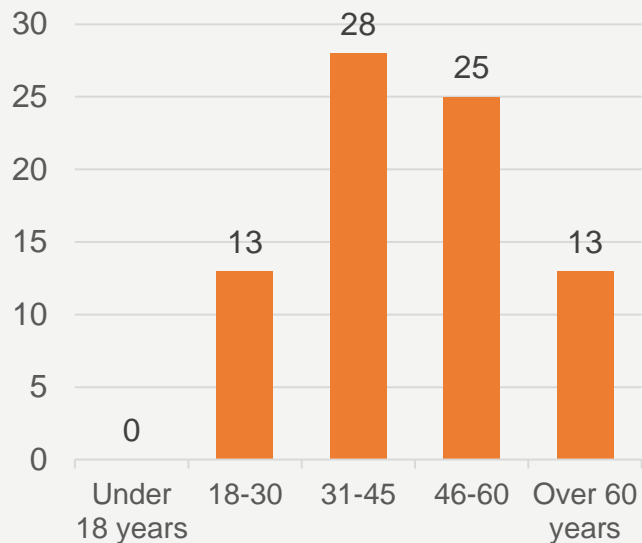


Background info

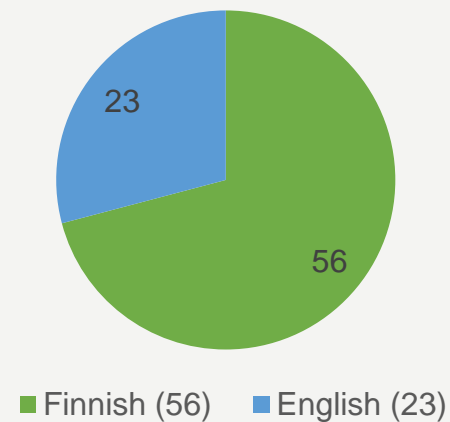
Gender (n=79)



Age (n=79)

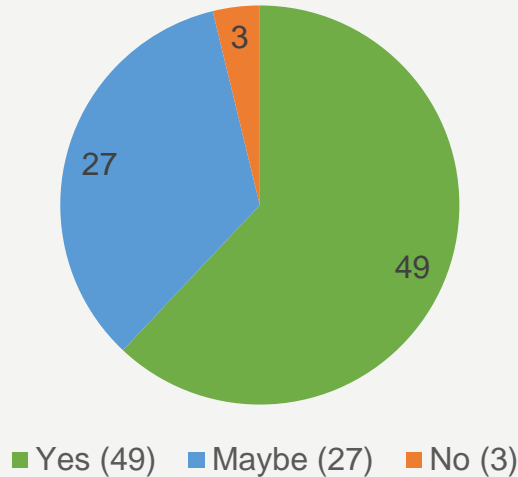


Language (n=79)



Majority would use robot bus for daily travel – positive experiences are needed

Would you consider using a robot bus as a part of your daily travel? (n=79)



I can't trust it is safe without an operator

After travelling, I prefer walking the last mile – not suitable for daily use

I prefer all different public transport modes

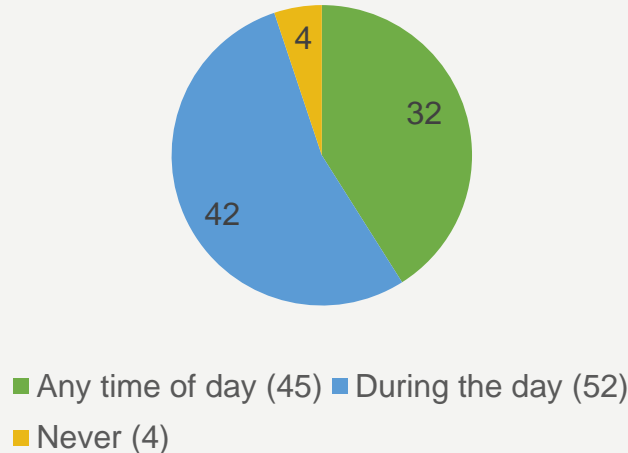
Speed, reliability and schedules are important

I could use it if it made my journey easier

I have no experience, I am not yet comfortable using one

Most would not use robot buses during the night due to safety concerns

When would you use a robot bus on your daily travel? (n=78)



I would feel unsafe without a operator or driver if travelling during the night

Who would help if other passengers are cause issues?

I don't travel daily

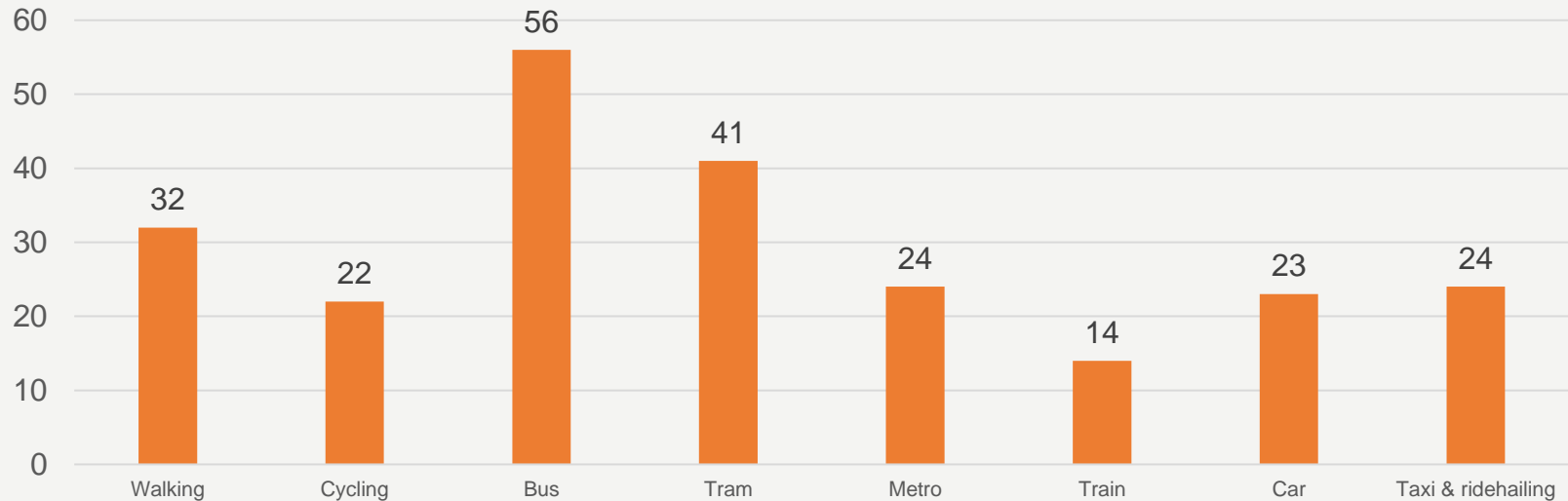
Safety is the first thing I started to think of

I rarely travel during the night

Hard to say without experience

Non-users would mainly replace bus, tram and walking with robot bus

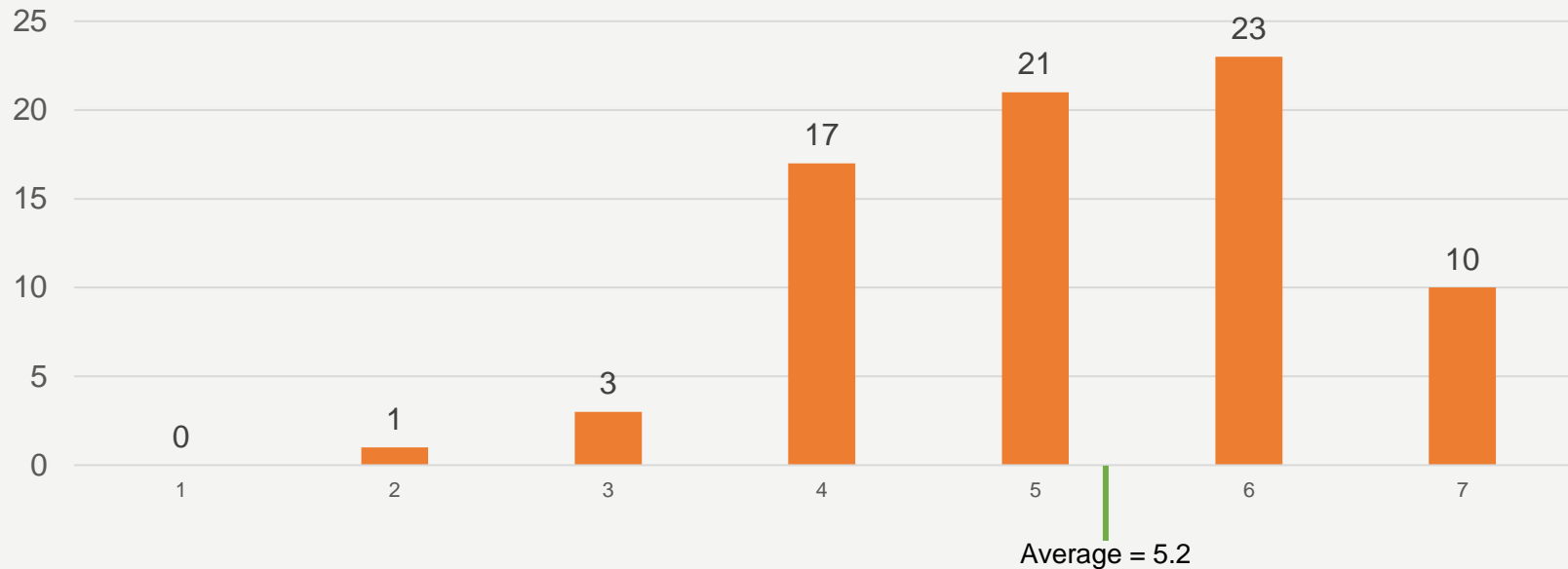
Which modes of transport could the automated shuttle bus replace? (n=79)



Note: Respondents were allowed to select multiple alternatives.

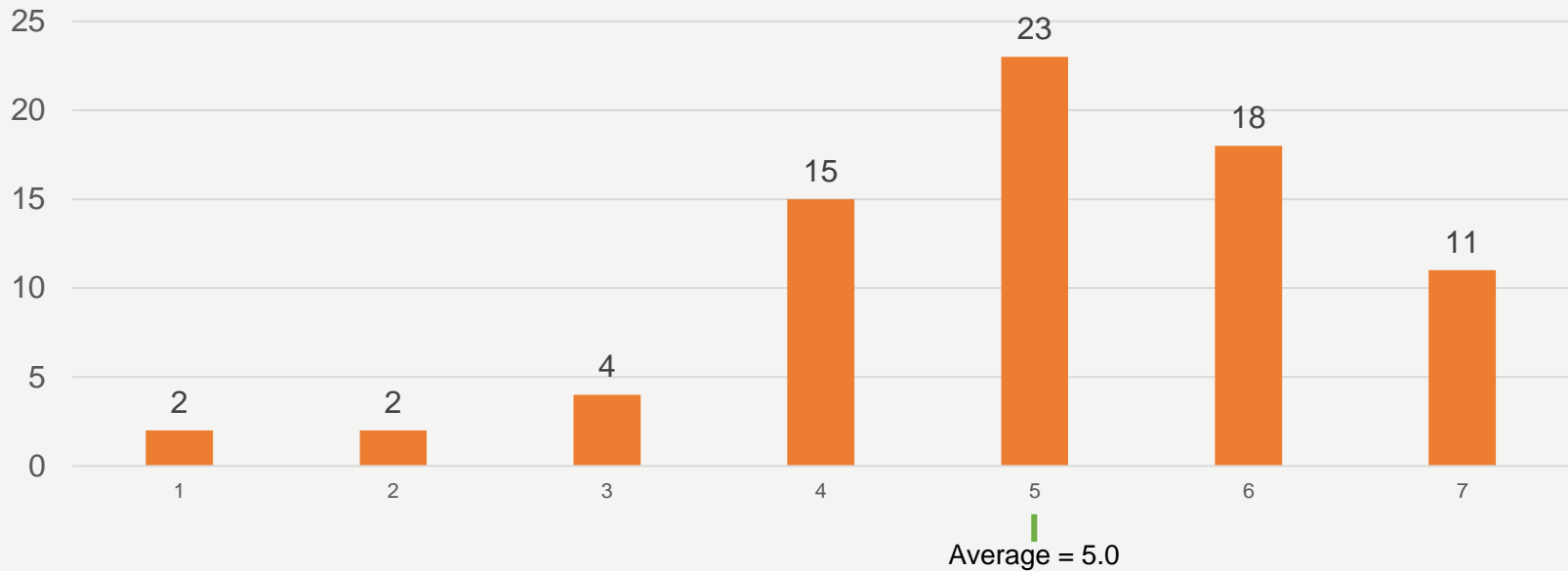
Traffic safety received positive score, but slightly lower than pilots participants'

How would you rate the traffic safety of a robot bus? (n=75)



Non-users also gave lower score for personal security than pilot users

How would you rate the personal security on board a robot bus? (n=75)



Passenger and traffic safety was a major concern for non-users

Robot buses need some sort of system for passenger security, such as CCTV and a monitoring center

Other passengers may cause a safety issue

How well does the bus operate in adverse weather?

The security system could monitor the noise level in the bus

The bus should communicate clearly with the passengers e.g. next stops, how to onboard etc.

How well does the robot bus interact with other road users?

Do the other road users know how to interact with the robot bus?

An emergency stop and connection to security operator is needed

Passenger safety during the night is a major issue.

Non-users had some ideas how to improve and utilize robot buses

If you have not used a robot bus, it is difficult to forecast whether you use it or not

Headway should be short, travel distance is often short

Robot buses could replace feeder lines in residential areas.

The robot buses in pilots have been slow – speed needs to be increased.

More pilots and routes in cities.

Acceleration and braking should be smooth. Otherwise older passengers may fall

Robot buses could be used during big events.

Robot buses might be cost-efficient if they replace the driver costs

They need to connect places people need to be used and gain trust for daily travel.

Some of the non-users were also very excited!

I hope these will be on the roads soon!

Super cool!

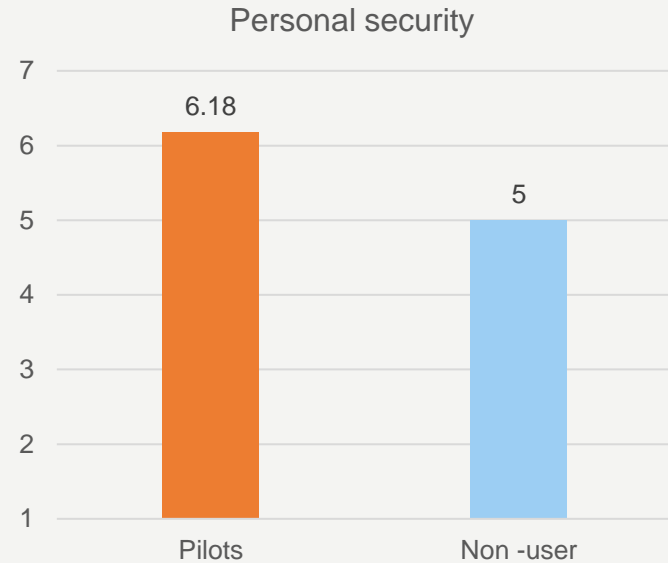
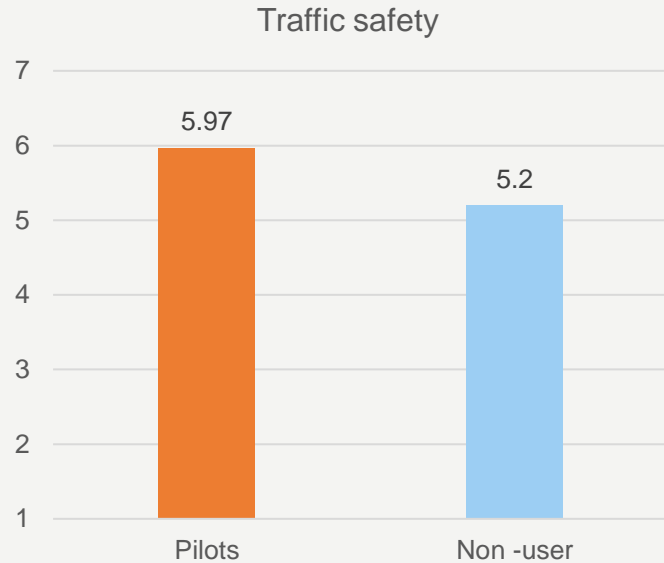
I have not tried – but I am really interested in trying!

It is not that much different than normal buses.

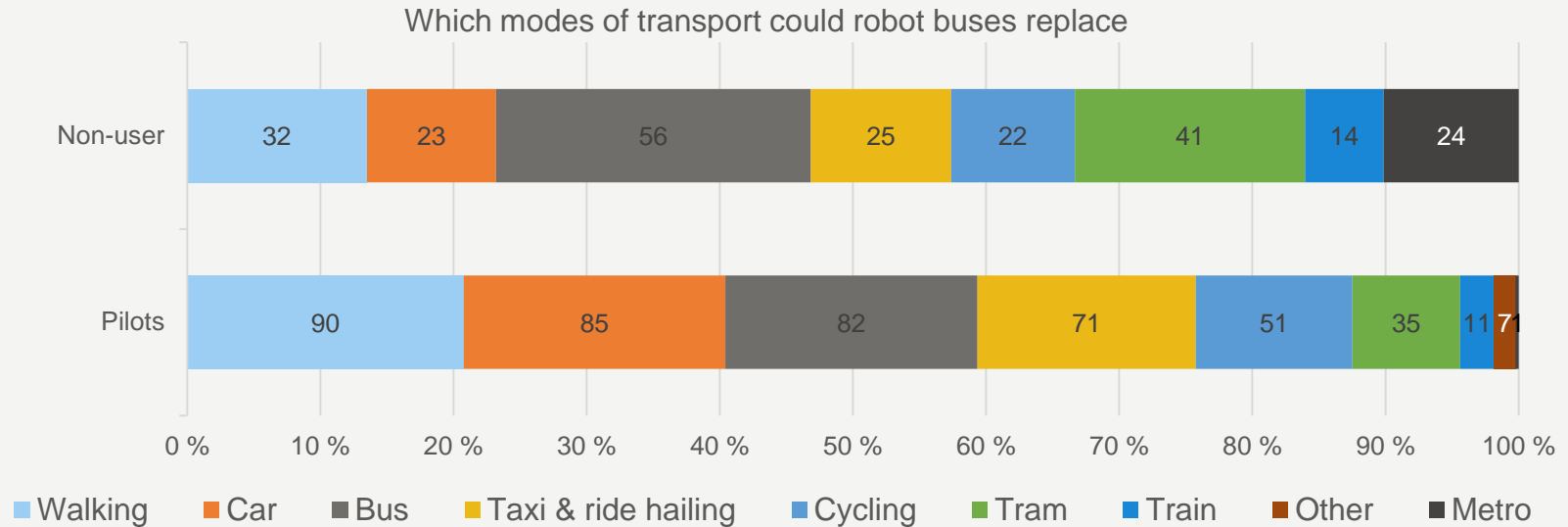
I would like to know more about these.

More robot buses to the roads!

Non-users perceived safety and security lower than pilot participants



Non-users see less potential robot bus replacing walking, car or taxi, more potential in replacing tram, bus and metro



Conclusions from non-user survey

- Compared to passengers in pilots, non-users gave lower average scores for traffic safety and passenger safety.
 - Especially usage during the night raised questions about safety and security, mainly related to misconduct by other passengers
 - Non-users also proposed some use cases, which seem realistic in future.
 - Interestingly, some non-users also raised questions about same topics as the passengers, such as acceleration, speed and braking.
- Responses indicate, that passengers need positive experience with robot buses to be more confident and to use them, although majority could use them for daily travel if robot buses were to help them in their travel.
- Respondents also have different opinions which modes of transport robot buses could replaced based on whether they have experience with robot buses or not.

Conclusions



FABULOS surveys and results from other pilots (1/3)

- Results from both FABULOS pilots and non-user surveys have very similar results when compared to other studies of user acceptance of robot buses and autonomous vehicles.
 - Demographics, such as gender, seem to have limited effect on the acceptance
- Passengers need some guarantee of personal security when on board (e.g. CCTV, remote security operators, driver or security stewards)
- There may be some national differences in the acceptance
 - It is difficult to pinpoint whether these are due to attitudes towards transport and driving, socioeconomic or cause by different type of routes and pilots organized.
 - In Sohjoa Baltic pilots, Tallinn and Gdansk had highest rating for overall experience. In FABULOS pilots, most positive experience was reported in Lamia and Tallinn. Other studies have indicated, that lower income level or more thrill-seeking population may be linked to higher acceptance and positive perception.



FABULOS surveys and results from other pilots (2/3)

- Overall, the acceptance is high, and people have mainly positive attitude towards robot buses, their safety and security, and ease of use.
 - Positive experiences are needed to enforce the acceptance further
 - Autonomous driving technology must evolve to be reliable without human operator and perception of personal security needs to be addresses
- Robot buses mainly seem to replace walking, which may not be favourable in many cases. There is some potential to replace other PT modes, such as buses and trams but also some potential to replace cars.
- Non-users rated the personal security and traffic safety lower than average pilot scores, indicating there might be less acceptance in the general public who is not so keen to test robot buses. When user acceptance is tested in pilots, the samples are often small and biased towards those who have more interest in technology.

FABULOS surveys and results from other pilots (3/3)

- While the user experience is good and acceptance is high, passengers note many areas of improvement.
- Based on the passenger comments and responses, the robot buses need to find their place in the transport ecosystem. Further, the autonomous driving technology has to prove its safety and be able to match and exceed the performance of human drivers, in terms of ride comfort, speed and safety.



Background: Key results from other pilots



Background: What other studies say about user acceptance and experience?

- Acceptance of driverless vehicles has been studied, both:
 - Driverless vehicles in general, and
 - Robot buses



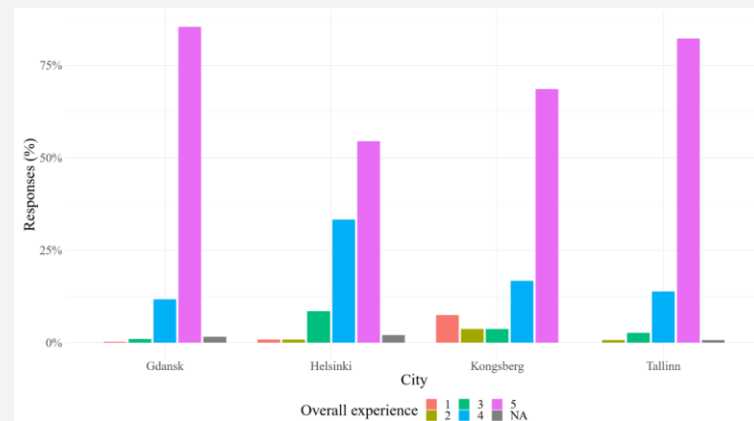
Background: Acceptance of driverless vehicles

- In a large (7755 responses) international survey (116 countries), acceptance of driverless vehicles was studied.
 - Respondents perceived driverless vehicles easy to use, convenient and could consider using electric driverless vehicles for public transport
 - Respondents believe they would have fun and enjoy the ride
 - Respondents want to have a button to stop the bus
 - Correlation between socioeconomic background and acceptance is low
 - Difficulty of finding a parking spot increases acceptance, which may indicate general transport-related issues may increase
 - Living in city and use of public transport increase acceptance
 - On national level, acceptance decreases when GDP increases
 - Low-income countries may have worse problems with traffic or population is more thrill-seeking.



Background: User acceptance in Sohjoa Baltic robot bus pilots was mainly positive

- In Sohjoa Baltic pilots, user acceptance was studied in passenger surveys in four different cities: Gdansk, Helsinki, Kongsberg and Tallinn
- Passenger gave high scores for overall experience, traffic safety and personal security.
 - Most respondents would use the bus without a operator, at least in future.
- The results indicate, that user acceptance is not related to sociodemographic factors.
 - However, all scores were slightly more positive in Gdansk and Tallinn



Background: User comments in Sohjoa Baltic raised some improvement ideas

- Most of the open comments were positive
- Typical improvement ideas were
 - Increase speed
 - More space
 - Increase the network or number of routes or frequency of service
 - Improve braking for smoother operation
 - Better interaction with other traffic



Background: In Finland, pilot participants have been positive about robot buses

- In earlier pilot in Helsinki, passengers have been surprised how safe it feels on board a robot bus, comparable to other means of transport where passengers rarely see the driver (tram, metro)
 - However, passengers tolerate more errors and accidents from human drivers than driverless vehicles. The safety requirements for driverless vehicles are higher.
- Routes, service level and flexibility are main determinants for use.



Background: In Germany, passengers had very similar concerns as in FABULOS

- In Berlin, robot bus passengers had positive attitude towards robot buses
- No major gender differences were found, older people exhibited higher intention to use robot bus but regarded the efficiency low compared to existing transport they use.
- Low speed and space for luggage received lowest ratings from passengers.
- Passengers also preferred having a supervision from an external control room.
- Passengers did not expect the robot buses to replace existing modes of transport.

Background: Also in Switzerland passengers had positive attitude

- User acceptance and trust in robot bus system was high in test trials in Neuhausen am Rheinfall.
- There are some concerns about interaction with pedestrians and cyclists, and about misuse of software and data.
- Some respondents (mainly women and under age of 40) had concerns about potential job losses due to driverless buses.

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