TAMPERE UNIVERSITY OF TECHNOLOGY

VERNE TRANSPORT RESEARCH CENTRE

User perspectives on self-driving last-mile buses and passenger cars in Finland

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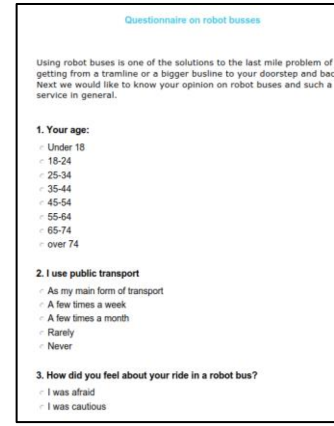
Outline

- Two cases and projects in Finland where Tampere University of Technology (TUT) did a survey
  1. SOHJOA - self-driving last-mile buses, user perspectives of a pilot (2016 - 2017)
  2. The views on robot cars, survey for 10 000 Finns (spring 2017)
- Key question
  – what are the current perspectives of ”the man on the street” regarding self-driving road vehicles?



Questionnaire on robot busses

Using robot buses is one of the solutions to the last mile problem of getting from a tramline or a bigger busline to your doorstep and back. Next we would like to know your opinion on robot buses and such a service in general.

1. Your age:

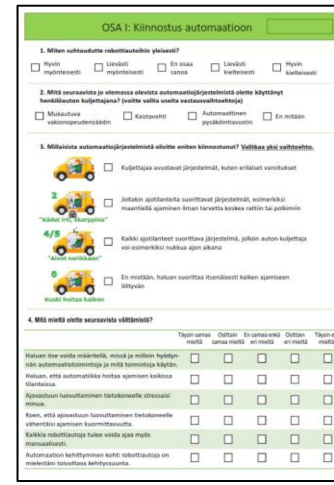
- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65-74
- over 74

2. I use public transport

- As my main form of transport
- A few times a week
- A few times a month
- Rarely
- Never

3. How did you feel about your ride in a robot bus?

- I was afraid
- I was cautious



OSA I: Kiinnostus automaatioon

1. Miten suhtaudutte robottiautoihin yleisesti?

☐ Hyvin myönteisesti ☐ Lievästi myönteisesti ☐ En osaa sanoa ☐ Lievästi kielteisesti ☐ Hyvin kielteisesti

2. Mitä seuraavista jo olemassa olevista automaatiojärjestelmistä olette käyttänyt henkilöauton kuljettajana? (voitte valita useita vastausvaihtoehtoja)

☐ Mukautuva vakionopeudensäädin ☐ Kaistavahti ☐ Automaattinen pysäköintiavustin ☐ En mitään

3. Millaisista automaatiojärjestelmistä olisitte eniten kiinnostunut? Valitkaa yksi vaihtoehto.

☐ Kuljettajaa avustavat järjestelmät, kuten erilaiset varoitukset

2 "Kädet irti, skarppina" ☐ Joitakin ajotilanteita suorittavat järjestelmät, esimerkiksi maantiellä ajaminen ilman tarvetta koskea rattiin tai polkimiin

4/5 "Aivot narikkaan" ☐ Kaikki ajotilanteet suorittava järjestelmä, jolloin auton kuljettaja voi esimerkiksi nukkua ajon aikana

0 Kuski hoitaa kaiken ☐ En mistään, haluan suorittaa itsenäisesti kaiken ajamiseen liittyvän

4. Mitä mieltä olette seuraavista väittämistä?

	Täysin samaa mieltä	Osittain samaa mieltä	En samaa enkä eri mieltä	Osittain eri mieltä	Täysin eri mieltä
Haluan itse voida määritellä, missä ja milloin hyödynnän automaatiotoimintoja ja mitä toimintoja käytän.	☐	☐	☐	☐	☐
Haluan, että automatiikka hoitaa ajamisen kaikissa tilanteissa.	☐	☐	☐	☐	☐
Ajovastuun luovuttaminen tietokoneelle stressaisi minua.	☐	☐	☐	☐	☐
Koen, että ajovastuun luovuttaminen tietokoneelle vähentäisi ajamisen kuormittavuutta.	☐	☐	☐	☐	☐
Kaikkia robottiautoja tulee voida ajaa myös manuaalisesti.	☐	☐	☐	☐	☐
Automaation kehittyminen kohti robottiautoja on mielestäni toivottava kehityssuunta.	☐	☐	☐	☐	☐

Case 1: SOHJOA-project

SOHJOA = Autonomous public transport vehicle that takes Finnish circumstances into account

SOHJOA-project's goals

- Offer an open innovation platform for Finnish companies
- Enhance understanding on transport transformation
- Permanent transport automation to biggest Finnish cities

Key issues with last mile transport

- Small and varying demand
- Expensive to organise
  - Labour intensive, high salary costs
  - Low potential of scale of economics

➢ Solution?

Autonomous shuttle service trial begins in Paris

11 July 2017 • Author(s): Eurotransport

A new, autonomous shuttle service has been launched in the heart of Europe's largest business district, Paris La Défense.

The service was launched by NAVYA and KEOLIS, in partnership with Paris public transport authority Ile-de-France Mobilités (Ex-STIF) and DEFACTO, following its inauguration on 3 July 2017.

Related transport topics

- Autonomous Transportation
- Navya

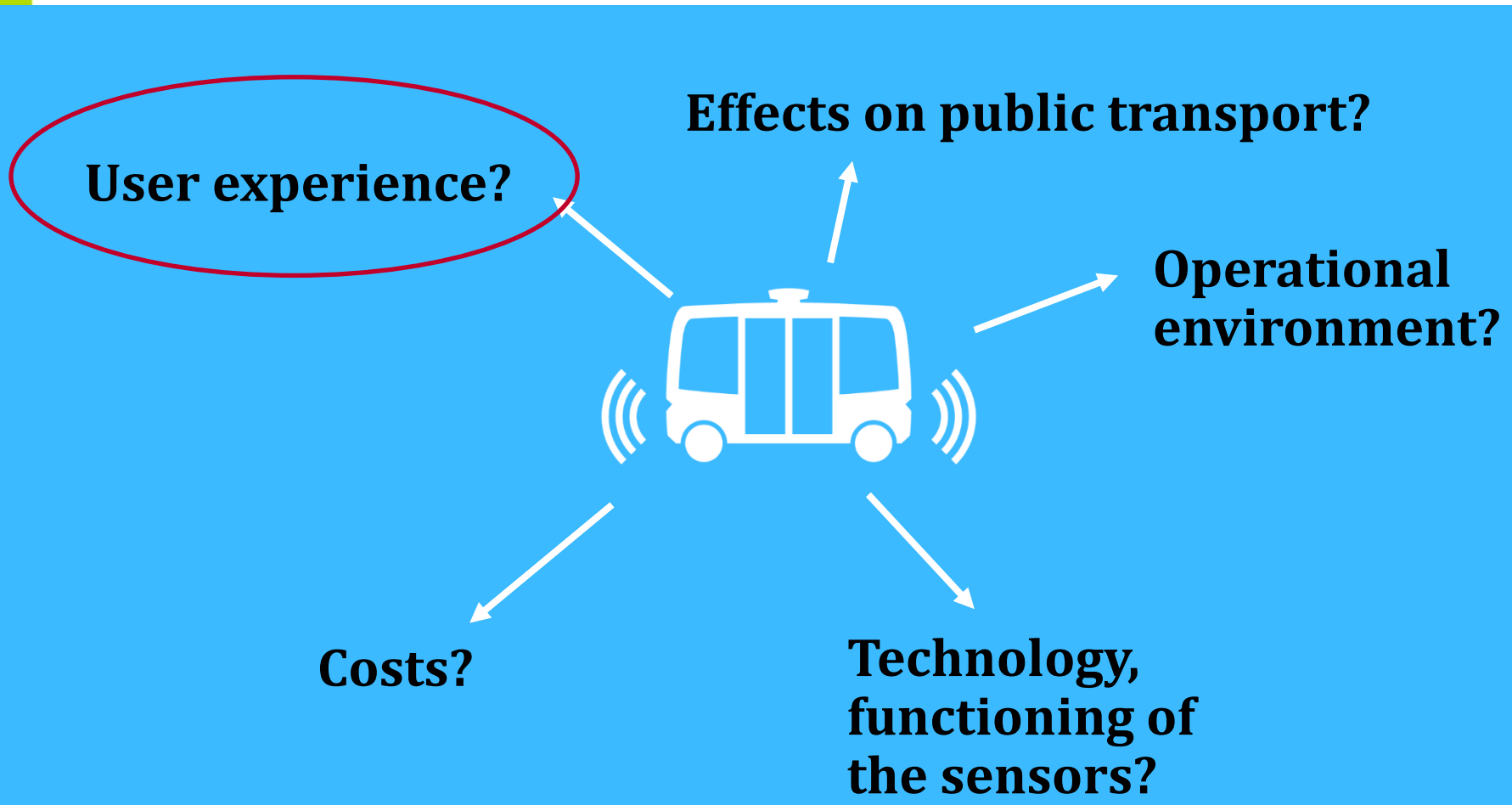
Related stories

The endless possibilities of smart cities

Driverless technology receives government grant

First autonomous shuttle project to be undertaken in Quebec

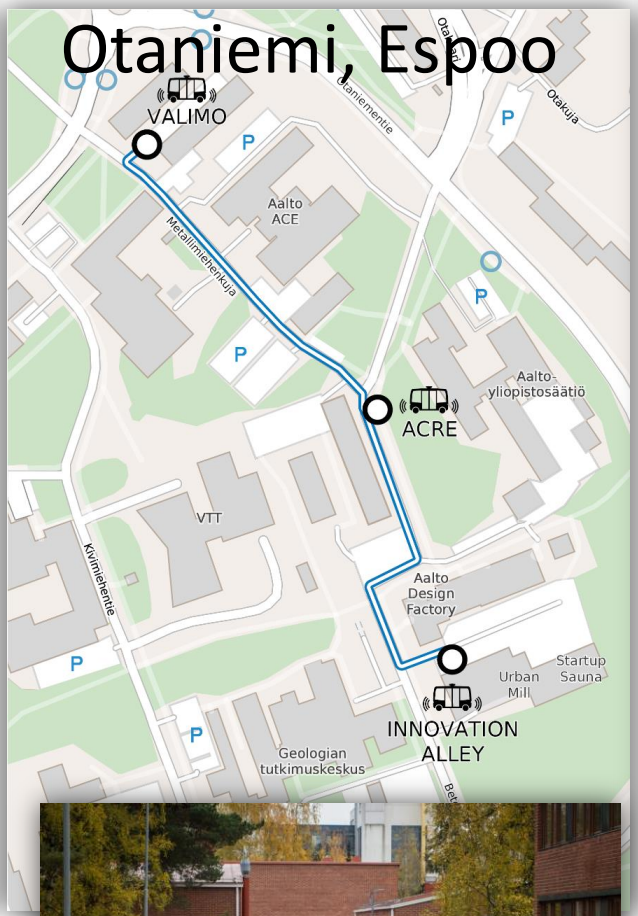
https://www.eurotransportmagazine.com/24367/news/industry-news/autonomous-shuttle-service-trial-begins-paris/


User experience?
Effects on public transport?
Operational environment?
Costs?
Technology, functioning of the sensors?

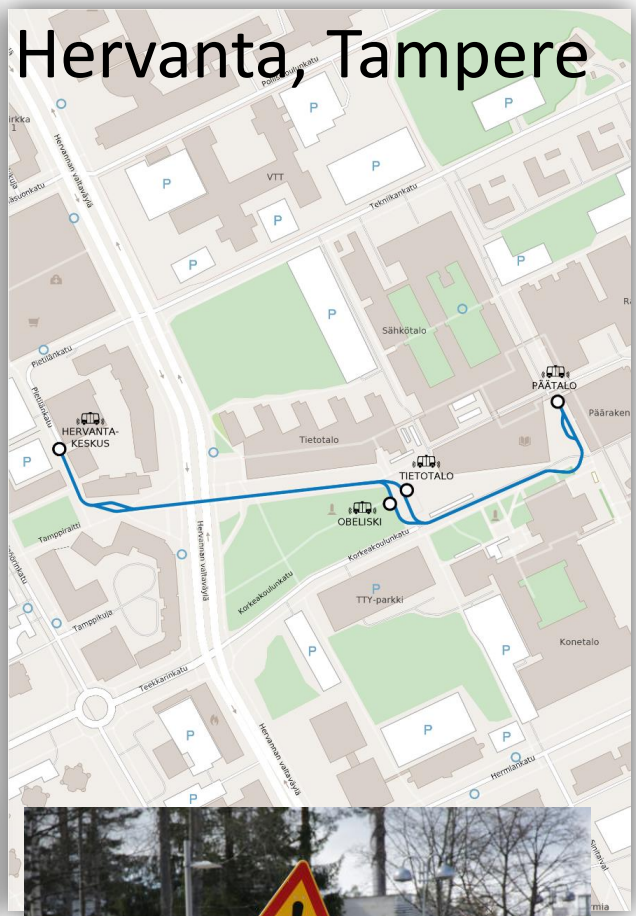
Three first pilot areas in SOHJOA-project

Hernesaari, Helsinki

Otaniemi, Espoo

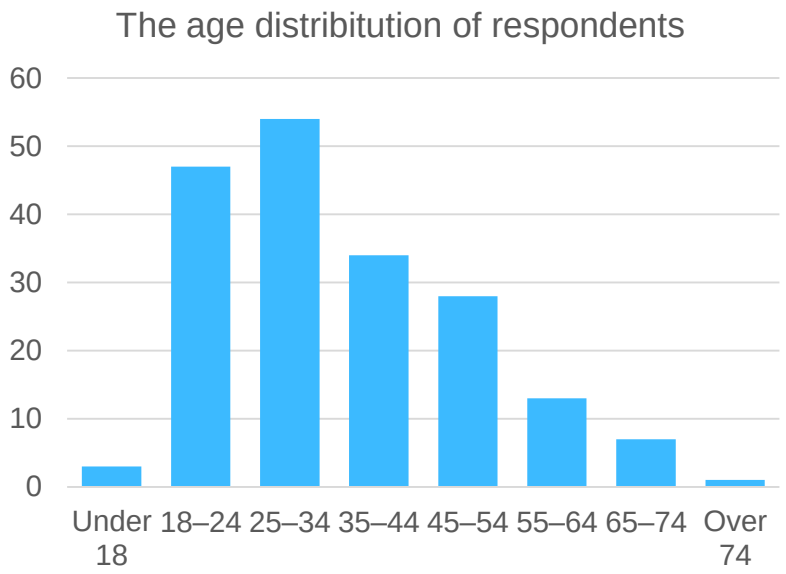


Hervanta, Tampere



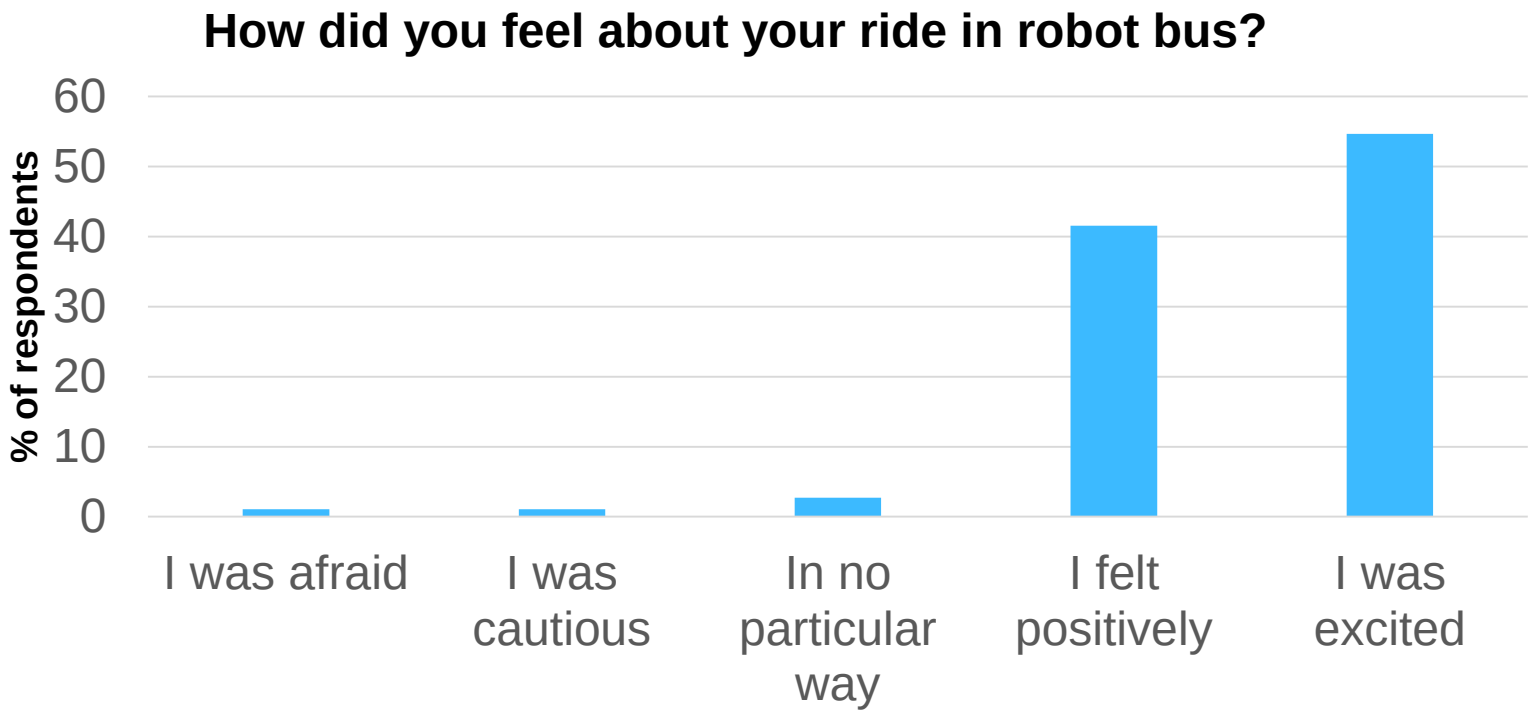
Survey for the robot bus users

- Conducted in autumn 2016 and spring 2017 when a robot bus was operating in Hervanta
- The survey questioned the users of this bus
- The goal was to determine the opinion of users on robot bus and on the service in general
- The survey includes 184 answers, dominantly from young adults



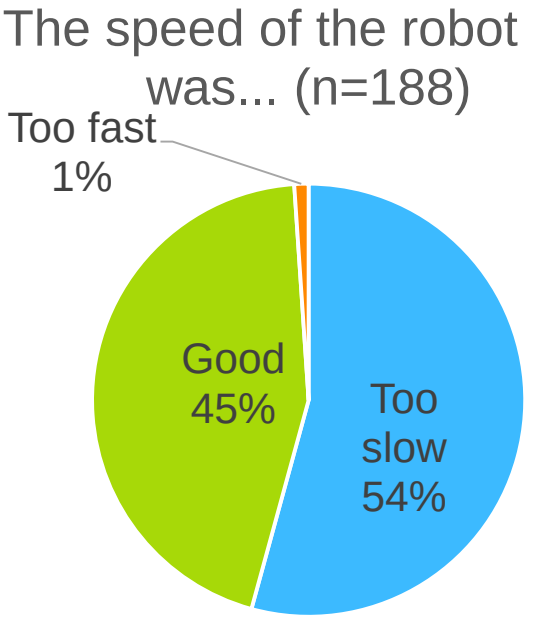
Survey results: Ride experience

- More than 95% felt the ride positively



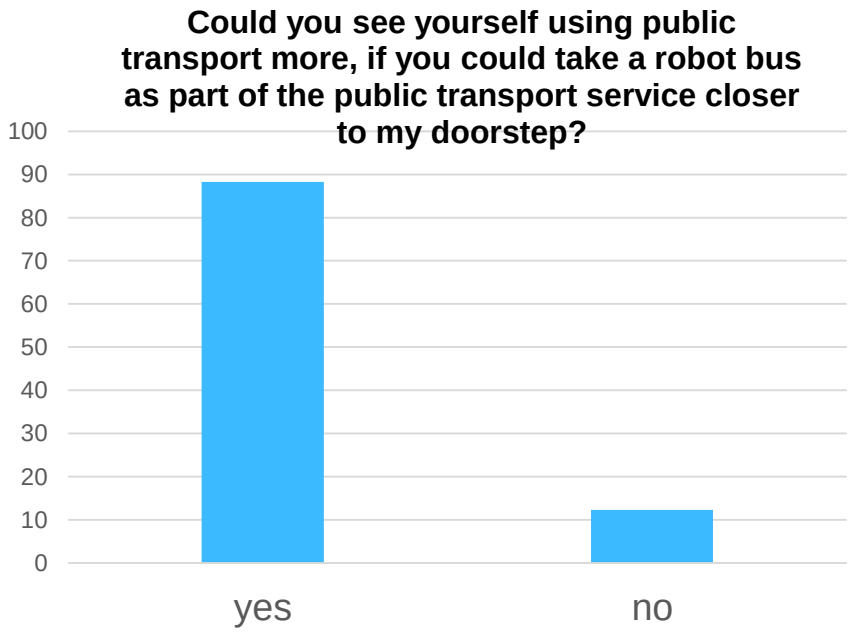
Survey results: Speed

- The speed of the vehicle in action was max 12 km/h - majority of the respondents saw this as too slow
- Most of the route was on pedestrian paths
- Passengers walking in front of the bus slowed the bus down
- The bus drove corners carefully and slowly



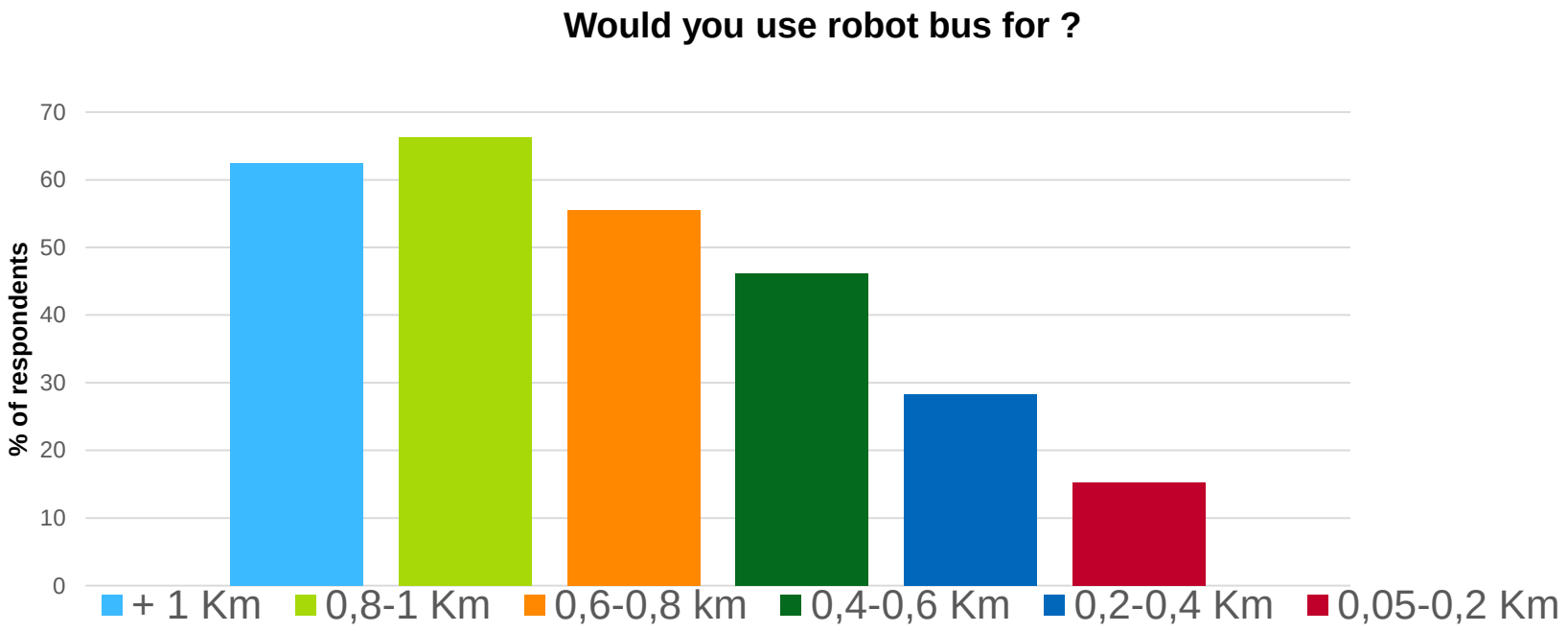
Survey results: Ride experience & willing to use as a last mile mode of public transport

- Only one respondent felt the ride as unpleasant
- Almost 90% saw that the service has potential to increase the use of public transport



Survey results: Preferred travel distances

- Especially distances of 400+ meters are of interest



Survey results: Willingness to pay

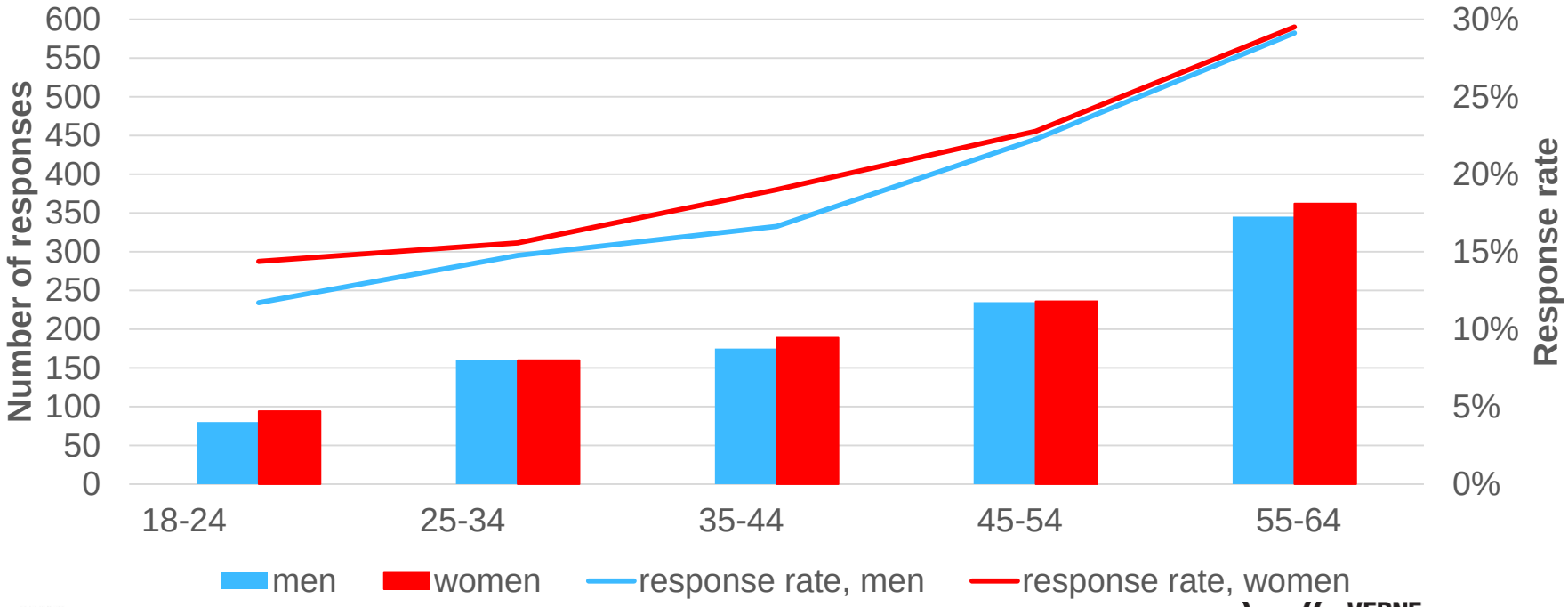
- Majority of the respondents were willing to pay about 30 - 50 eurocents extra to the regular public transport fee (current fee is 1,84 € when paid with a smart card in Tampere)

Safety related observations from case 1

- Some people said that they would not ride the bus if the operator wasn't on board.
- People were wondering what happens when someone or something comes in front of the bus.
  - Passengers were afraid that the bus does not avoid obstacles.
- Some passengers were looking for safety belts.
- Safety is a concern: how is personal safety guaranteed if there is no driver or operator?
  - Harassment, violence, abuse, vandalism
  - Need for security cameras?

Case 2: Large survey to Finns on robot cars in spring 2017

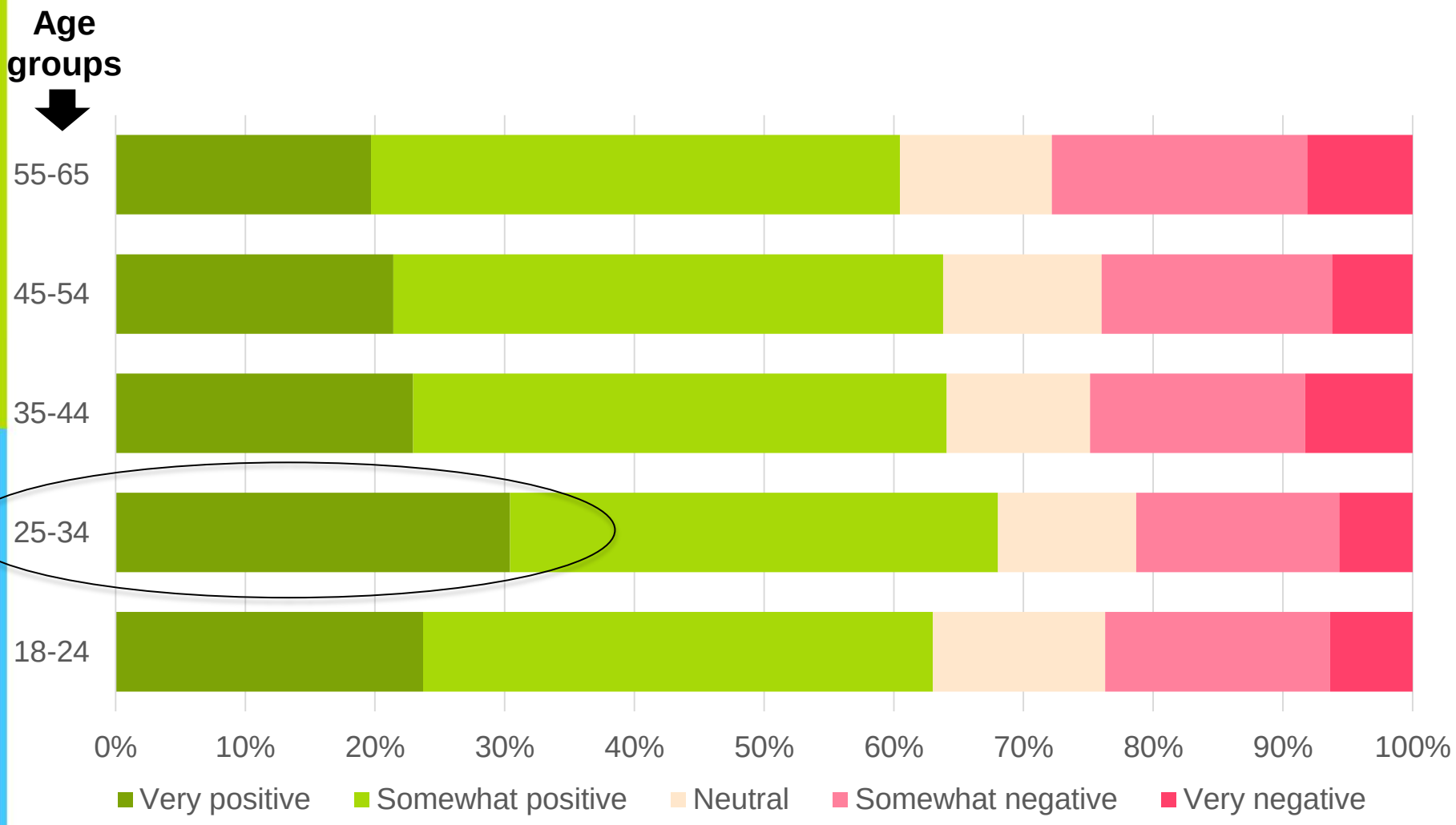
- Conducted in a project in co-operation between Tampere University of Technology, Finnish Transport Safety Agency and Finnish Transport Agency
- Sample of 10 000, representing 18 to 64 year old Finns, 2036 respondents (1041 women, 995 men)



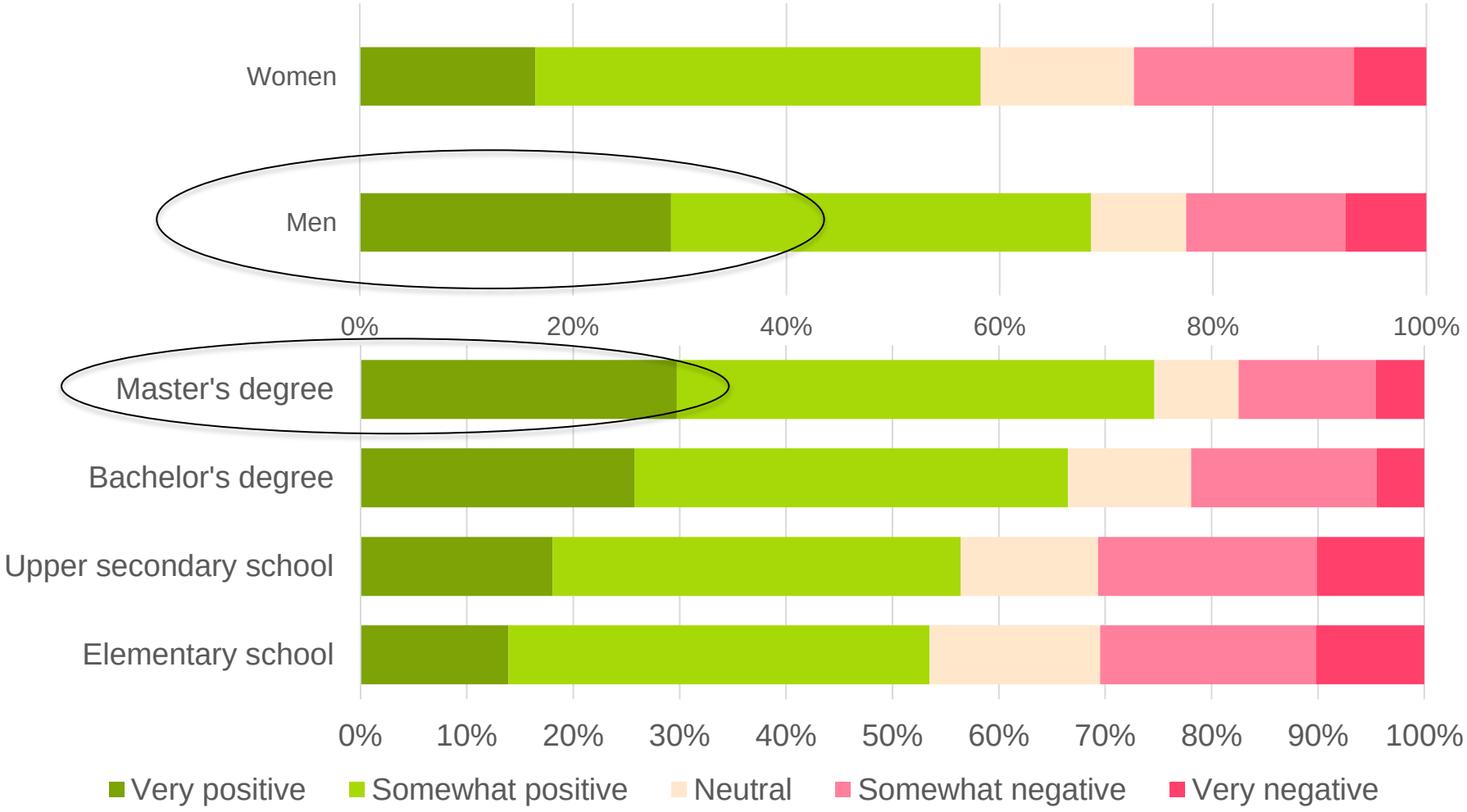
Literature survey related to case 2 (Timo Liljamo, Masters of Science Theses)

- Tests ongoing and legislation prepared to allow robot cars in normal traffic
- Expected benefits from robot cars:
  - Safety, environmental impacts, efficiency
  - More positive than negative effects on costs (esp. lower costs for shared cars and robot taxis)
  - Current service levels could be achieved with almost 90% smaller car pool in big cities if the cars were shared => potential to decrease car ownership
- The length and amount of trips is expected to increase
  - Travelling becomes more convenient
  - New demand from people who currently do not drive cars
- Effects on the modal share are unclear

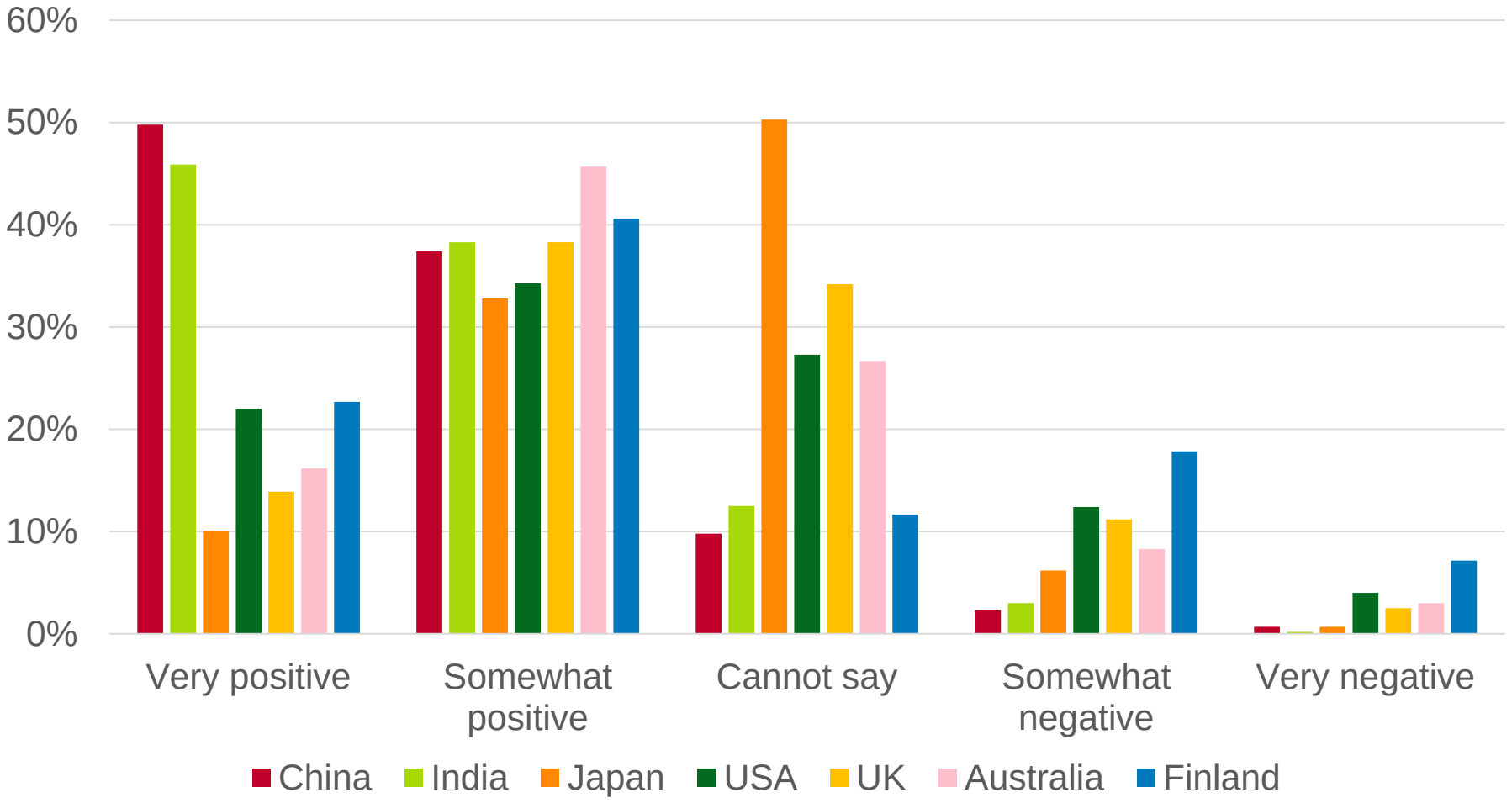
Survey results from spring 2017: General opinion regarding robot cars



Survey results from spring 2017: General opinion regarding robot cars

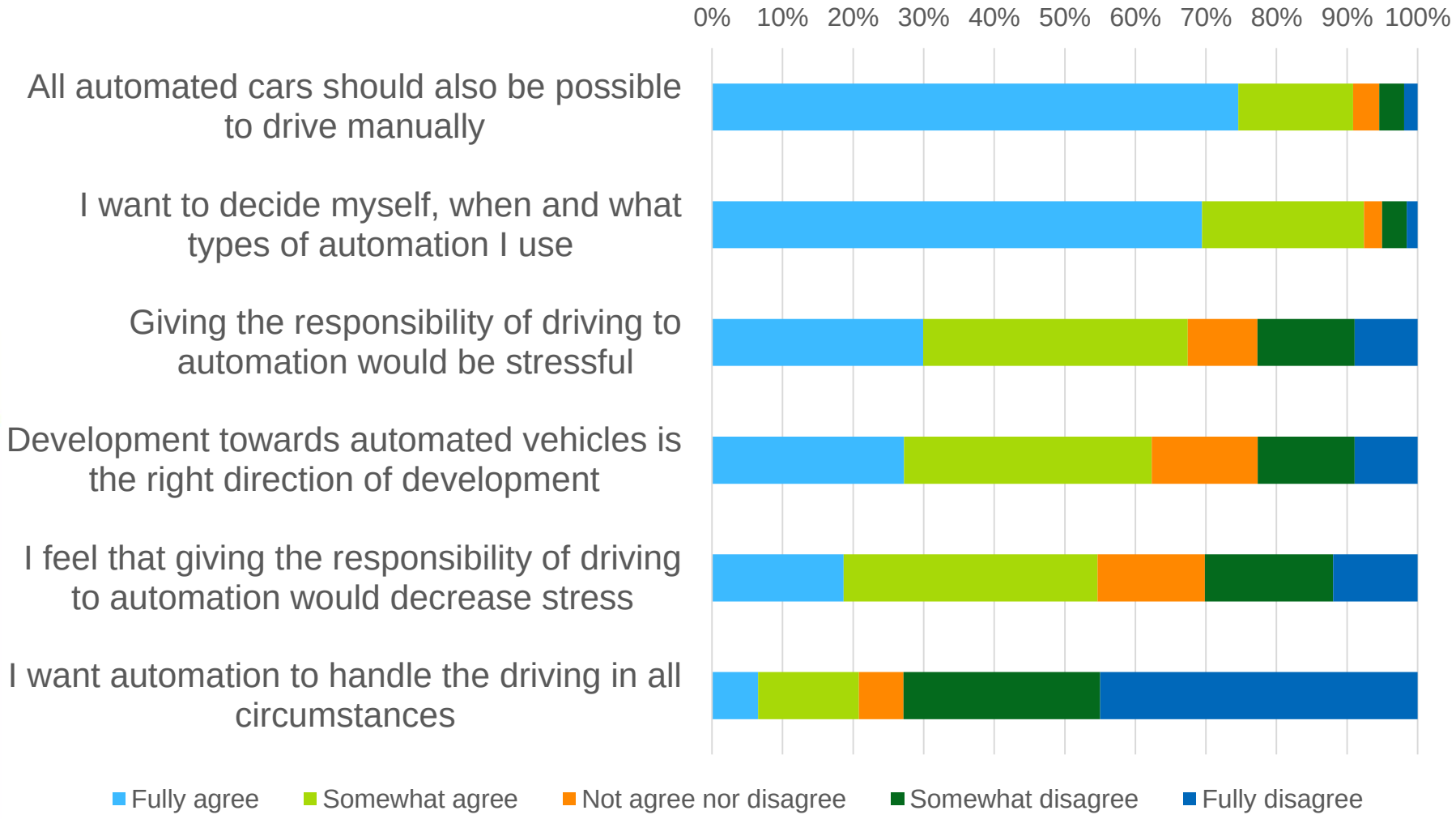


Survey results:
General attitude towards robot cars

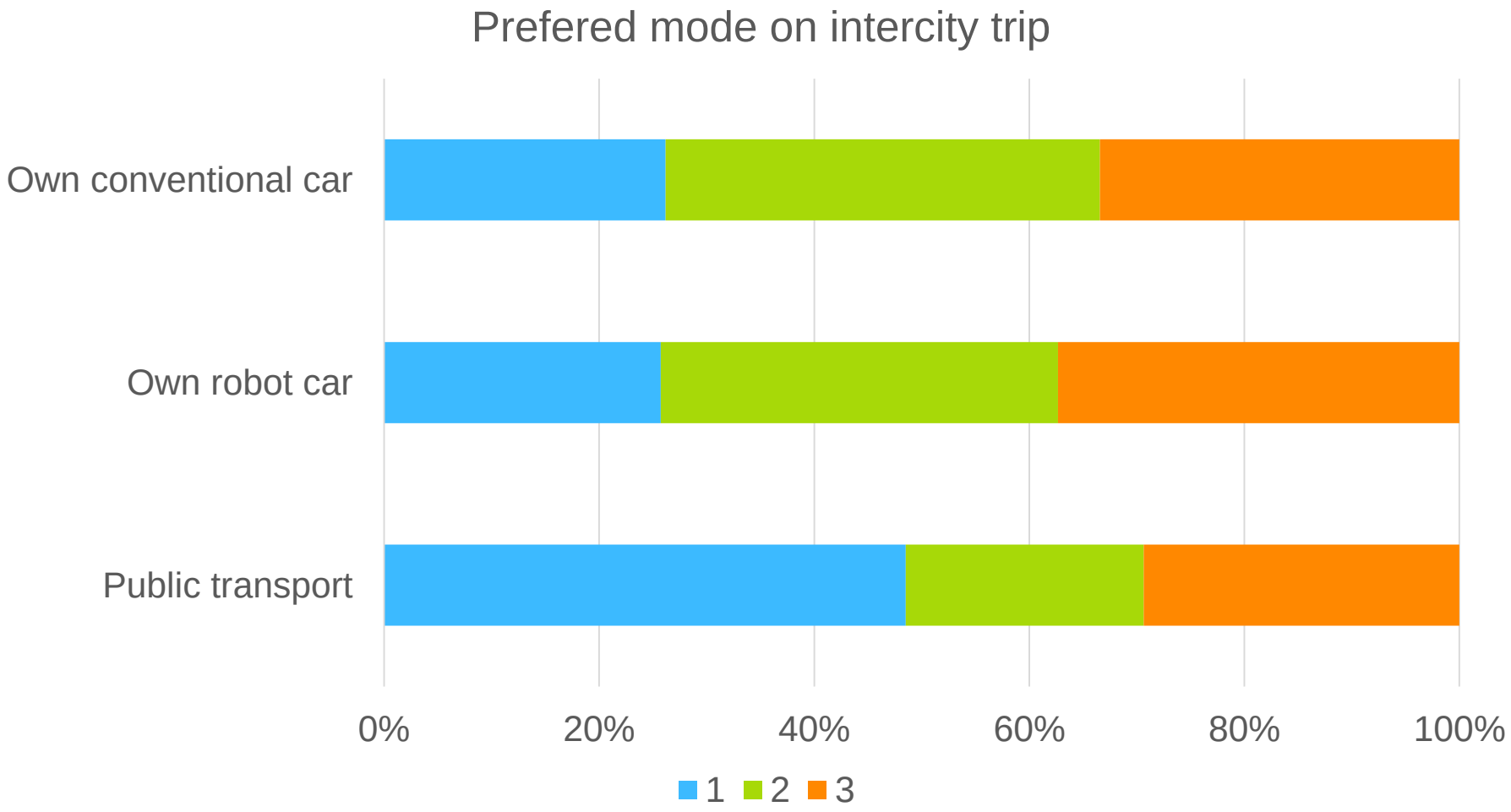


Figures regarding Finland from the survey in spring 2017.
Figures regarding other countries from Schoettle & Sivak (2014).

Attitudes in Finland, survey results from spring 2017



Effects on modal split
(1 = most preferred, 3 = least preferred)



Major worries concerning robot cars (respondents chose from given options)

Survey in spring 2017

- Traffic safety (accidents)
- Robot car wouldn't meet my moral standards in dangerous situations
- Unreliable technology (journey is interrupted)

Liikenneturva & Kantar TNS Oy 2016

- System failure (no response, bad programming)
- Functioning of technology in Finnish circumstances
- Distrust in machine's ability to solve moral conflicts
- Computer viruses, hacking (somebody controlling the vehicle from outside)

Autonomous vehicles will not prevent half of real-world crashes

http://www.itsinternational.com/categories/detection-monitoring-machine-vision/features/autonomous-vehicles-will-not-prevent-half-of-real-world-crashes/

First published in ITS International March April 2017 as Real-world conditions will limit AV safety gains

Alan Thomas of CAVT looks at the reality behind the safety claims fuelling the drive towards autonomous vehicles.

The case for autonomous vehicles (AVs) is usually made by saying 90% of crashes are caused by driver error, so remove the driver and you avoid 90% of crashes. However, this simplistic approach ignores the real-world causes of collisions and fails to acknowledge the challenges facing the developers of smart systems.

Work being undertaken by **CAVT** includes researching how a range of road and traffic scenarios can produce atypical conditions in which drivers, and particularly autonomous and advanced driver assistance systems (ADAS) are faced with instantaneous choices. The outcomes of these choices range from inconsequential to a fatal collision, and the research supports the development of ADAS which take account of the real world - not the world we would like it to be.

The TSR system has detected the (lower) construction zone speed limit so intelligent speed adaption would limit the vehicle speed accordingly.

SCIENTIFIC AMERICAN

English

AUTOMOTIVE

How Pedestrians Will Defeat Autonomous Vehicles

The 'game of chicken' which could be a serious problem for driverless cars

By Karinna Hurley on March 21, 2017

https://www.scientificamerican.com/article/how-pedestrians-will-defeat-autonomous-vehicles/

TAMPEREEN TEKNILLINEN YLIOPISTO

VERNE TRANSPORT RESEARCH CENTRE

Major benefits from self-steering cars (motorists, n=1238)

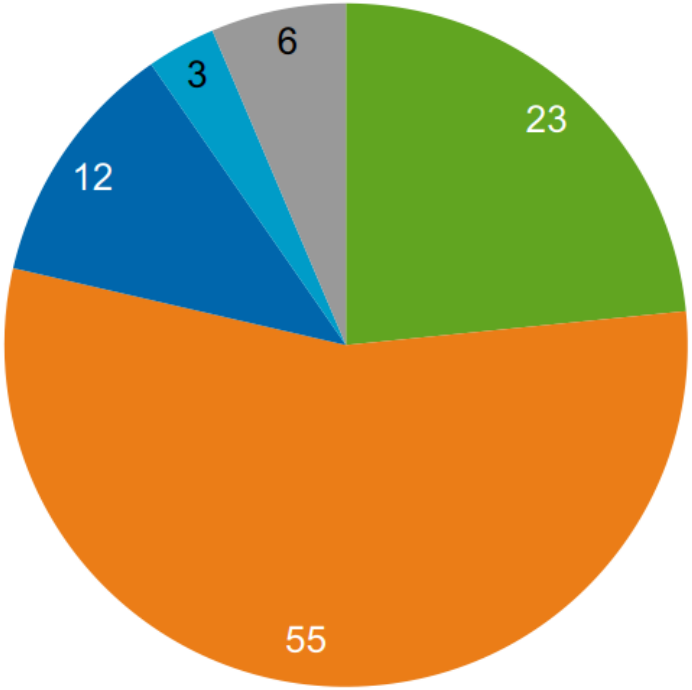
- Decreased amount of human errors
- Roads will be in better condition to allow the technology to work
- Seniors retain the possibility to travel by car
- Less congestion and pollution
- Car can park itself so that no-one needs to be in it
- Lower transport costs
- You can do something else while driving
  - read, eat, enjoy the scenery, play, …

Source: Suhtautuminen itseohjautuviin autoihin (attitude towards self-steering cars, in Finnish) Liikenneturva ja Kantar TNS Oy 2016

Survey results in spring 2017

- 2/3 of the respondents would prefer a robot taxi in the case when the robot car would be available in about 7 minutes and the use of the car would be similar to own car but without car ownership costs (avg. 2,000 euros a year)
- 2/3 would not need/want to own a robot car if all the cars were robot cars
- 3/5 would travel more by car if the total costs of car travel were more inexpensive than today
- 2/5 would travel more when it is possible to do something else (e.g. read) during the ride/drive
- 1/3 would travel more if it were possible to use the car regardless of one's driving condition

If you had full freedom to choose, what type of car would you choose? (motorists, n=1238)



- A traditional car with electronics as little as possible
- A modern car that has automatics as lane keeping assist, collision warning, ESC/ESP, etc., but driving is self managed
- Self-steering car that takes car of everything related to driving autonomously but the driver can drive if needed
- Robot car that takes care of everything related to driving autonomously
- Cannot say

Liikenneturva ja Kantar TNS 2016.

Source: Suhtautuminen itseohjautuviin autoihin (attitude towards self-steering cars, in Finnish) Liikenneturva ja Kantar TNS Oy 2016

Willingness to pay for autonomous driving technology

- In a survey by IHS Markit to 5,000 vehicle owners in the US, Canada, Germany, the UK and China, just 44% of all respondents indicated that full autonomy would be a desirable feature in their next car, the lowest rank of all the technologies surveyed.
- Despite this, autonomous technology ranked as what consumers would be most willing to pay extra for in their next car.
- Blind spot detection ranked as the most desired feature among all audiences.

TU Automotive, Weekly Brief, 2017-08-07

Summary

- Safety is a great concern and expected benefit from automated road transport
- People who have travelled on robot bus are quite enthusiastic towards the mode and indicate a willingness to pay for it as a last mile transport solution
- About 20% of survey respondents in Finland were very positive and about 40% somewhat positive towards robot cars
- Respondents want to be able to drive the robot cars manually
- Many prefer the robot car over an traditional car in future, but today most people prefer to be self managing the driving