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# D4.7

# User requirements analysis

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| PP | Restricted to other programme participants (including the GSA) | |
| RE | Restricted to a group specified by the consortium (including the GSA) | |
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AUTOPILOT

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**Abstract**

D4.7: User Acceptance assesses user requirements, concerns and expectations with a view to ensure their acceptance and trust. This is achieved by means of a multi-country online survey targeting naïve users, which inquires about the users' perspective towards a selection of services tested in AUTOPILOT.

This report introduces the survey design and summarizes first results from the online survey. This first (from overall three) surveys focusses on a touristic service in Versailles, which will be tested as part of AUTOPILOT on the French test site. The survey was conducted in eight selected countries in May and June 2018. The results are discussed in the context of the project focus. A first set of

recommendations for the development of the service were drawn from the results of the survey and summarised in this report.

## Legal Disclaimer



## Abbreviations and Acronyms

| Acronym | Definition |
|---|---|
| EC | European Commission |
| PO | Project officer |
| GA | Grant Agreement |
| WP | Work Package |
| IoT | Internet of Things |
| AD | Automated driving |
| UK | United Kingdom |

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## Executive Summary

The aim of the evaluation task 4.5 “User Acceptance” in AUTOPILOT is to analyse requirements, expectations and concerns of potential users of different use cases of automated driving progressed by IoT. The methodology used for the evaluation is twofold. On the one hand, the tested scenarios will be evaluated from the perspective of potential users (who do not have experience with the services), based on a multi-country online survey. On the other hand, an evaluation of the tests at the pilot sites from the perspective of potential/test users will be carried out. This deliverable reports the study design for the online survey as well as preliminary results from the first of three surveys in total, providing recommendations for both the set-up of the use-case pilot sites and the evaluation to be carried out at the test sites.

The online survey introduced a multi-stage scenario of a use-case with an accompanying questionnaire designed to evaluate it from the user perspective. The respondents were recruited using a professional service provider. At a later stage, additional respondents will be recruited via social media and partner networks. Overall, three selected scenarios will be evaluated – using a carsharing touristic service in France, using a platooning service in the Netherlands, and using an automated valet parking service. The surveys are conducted in the following countries: Finland, France, Germany, Greece, Italy, Netherlands, the UK and Spain.

Overall, the vast majority of the respondents evaluated the services described in the survey as a positive experience, which was exciting, safe and easy to use. Based on the results of the study, some general recommendations for developing the services were derived. First, the results suggest that making the services easy to use and customizable plays an important role in ensuring user acceptance (i.e. willingness to use the service). Second, coping with concerns related to the safety during the execution of the self-driving functions by providing sufficient information about what the vehicle is doing or about to do for instance, would be crucial. In all these aspects, the IoT will play a crucial role in enabling the provision of more detailed information in real time. Concerns related to payment security and malfunctions are important for both developers and service providers and users, as they can potentially affect users’ trust in IoT systems’ use during automated driving.

IoT can enable using the services with AD through easier trip planning by providing real-time traffic system information. This aspect is related to the performance of the system. Furthermore, IoT can accelerate the market deployment of AD services as trust in the system is increased by providing information about the vehicle operation – one aspect which is crucial for user acceptance of AD. This point can be considered as a base IoT-function for AD mainly because it increases the sense of control when driving automatically. Last but not least, IoT can contribute enhancing the user experience by providing real-time information about POIs and enabling customization options. This aspect is rather an excitement than a performance factor which can be also crucial when considering using an AD-based service.

All in one, all aspects – making the service useful from user perspective, its performance understandable and reliable as well as enhancing the experience - have to be considered when developing new services. The weight, i.e., the importance, of the different factors on the decision for using the service, can be further explored in future research.

# 2 Introduction

## 2.1 Purpose of the document

This document presents the results of an analysis of user requirements, concerns and expectations conducted under task 4.5 led by the FIA. Being the first of two deliverables in T4.5, this analysis validates findings of tasks 4.1 (Evaluation methodology), 4.4 (Quality of Life impact assessment) and 4.6 (Legal Issues). Furthermore, the findings of the analysis will add value to the outcome of the project by feeding into the design of the pilot testing and on-site user evaluation, thus allowing for the alignment of the services closer to the user.

## 2.2 Terminology

***Users*** are understood here in a broader definition as "*anyone who uses the AUTOPILOT functions and services*".

***Other road users*** are road users that are indirectly affected by the use of the AUTOPILOT technology (i.e. in the single use cases), e.g. cyclist, pedestrian, drivers of conventional vehicles; this group can be also interpreted as a part of the stakeholder groups.

***Acceptance*** Degree of intention to use or of incorporation of AUTOPILOT services.

## 2.3 Structure of the report

The report is structured as follows: Chapter 3 elaborates on the background of the survey, locating among the existing research on user acceptance, and formulates the aim of the analysis. Chapter 4 sets out the underlying methodology, building on the framework delivered in D4.1. Chapter 5 introduces the three driving scenarios used in the online survey, all derived from actual scenarios tested at the pilot sites, before the results of the survey are summarised in chapter 6. Chapter 7 transcripts these results into concrete recommendations for the pilot testing, followed by concluding remarks in chapter 8.

# 3 Background and aim of the user survey

## 3.1 Background

This deliverable sets out to examine user acceptance (T4.5) as part of the evaluation activities (WP4) in AUTOPILOT.

User acceptance forms a crucial part in the introduction of new technologies, being a determining factor for their potential to gain market traction and be inclusive. User acceptance can be defined as the demonstrable willingness within a user group to employ an information technology for the tasks it is designed to support (Kaan, 2017).

As using the Internet of Things (IoT) to enhance automated driving functions is still a very recent application, both the users' understanding of potential services, and the industry's experiences in designing them are limited. With this limitation in mind and considering the rapid pace at which the

domain is evolving, the user acceptance task in AUTOPILOT will evaluate the tested services in a multiple-step process. This report builds on a multi-country online survey, to inquire users' requirements, concerns and expectations towards some of the tested services before the actual piloting takes place. As described below, the findings will be fed back into the design of the pilot testing, with the goal of ensuring users' acceptance and trust of the aforementioned services. In order to take into account the rapid change in the automated driving landscape, this report will be updated in a few months' time, revisiting the analysed scenario and adding two more scenarios with different potential services.

Seeing that the topics as well as the applied methods of the User Acceptance task overlap with those of Business Impact Assessment (T4.3), Quality of Life Impact Assessment (T4.4) and Legal Issues (T4.6), the results of the below analysis will be shared with those tasks.

The work in task 4.5 User Acceptance is twofold – addressing requirements, expectations and concerns from the perspective of potential users who are not familiar with and have not experienced the services. The results from these analyses are summarised in this deliverable (D4.7). The second and main part in this task continues in the evaluation of user acceptance on the test sites, i.e., will focus on the evaluation from the perspective of users who experience the services or part of the services in the framework of the pilot tests. The results from these works will be summarized in D4.8. Table 1presents the contents of both deliverables.

| D4.7 – User Requirements | D4.8 – User Acceptance |
|---|---|
| • General deliverable<br>• Multi-country general public survey<br>• Potential input to T4.3, T4.4, T4.6 | • Pilot site deliverable<br>• Tailored focus group interviews<br>• Main output of T4.5 |

**Table 1: Overview of deliverables in T4.5 User Acceptance**

### 3.2 Aim of the online survey

As established in D4.1, the objectives of user acceptance assessment in AUTOPILOT are to:

- Formulate IoT-related improvements for automated driving functions based on user feedback, and to
- Determine whether there are improvements or added value in automated driving functionalities with and without the assistance of the IoT regarding user acceptance.

Within this overarching goal, the aim of the online user survey is to analyse the user requirements, expectations and concerns with a view to ensure their acceptance and trust in the piloted IoT-enhanced automated driving functions.

Contrary to existing quantitative user acceptance surveys, the present survey does not only focus on the anticipated usefulness and ease of use of these services and functions, but rather the added value from singular IoT functions. Furthermore, instead of examining the user as a mere research object, this analysis considers the user as a co-designer of future IoT-enhanced automated driving functions. Thus, the conducted survey assesses which functions and features are important, useful or desirable and inquires about the users' main concerns related to the potential usage of these services.

## 4 Methodology

### 4.1 Research approach

As the services and features considered in the project were in an early development phase, the evaluation of the user acceptance in terms of willingness to use the technology followed an iterative approach aiming to assess user requirements in the (early) development stage of the tested services. The proposed approach is a mixture between a user-centred design and participatory design. The user-centred design "is research-led and the expert mind-set defines the people as the objects of the study" while the participatory design "is an approach to design that attempts to actively involve the people who are being served through design in the process to help ensure that the designed product/service meet their needs" (Sanders, 2006). The user-centred design part of the used approach reflects the fact that we concentrated the study on the evaluation of already developed scenarios presenting tested services with particular features from user perspective. In this sense, we study potential users as objects, analysing their reactions on the presented service. On the other hand, however, the used approach has participatory elements allowing the respondents to decide which features are most relevant and desirable for the presented service and to suggest own improvement ideas on how to develop the service further. Participation of users in the design process can take place at different levels including conducting surveys with potential users about their wishes and needs and letting users testing prototypes and giving feedback to the researchers (Friedhof, 2016). The proposed iterative process of the user evaluation in AUTOPILOT includes both levels.

The feedback collected from the respondents through the online survey is being used to develop and improve the AUTOPILOT technologies and services even before the implementation phases of the project. The main goal is here to ensure that the system meets their needs (it is useful for them) and is usable or ease to use. We adapted the framework to the need of the project and combine it with theories on technology acceptance.

Figure 1 gives an overview of the general approach of the user acceptance evaluation. The presented approach integrates two main parts of the evaluation of the developed services – the first one is assessing **user preferences** of the general public in an online user survey and the second one is using the results in an **iterative development loop** where additionally test users were asked to evaluate their experience with the services. Feedback drawn from the results of these evaluation methods is provided to the service developers for design changes. The online survey presented in this report is part of this iterative process and plays an important role in the development of the services by providing a first feedback on requirements and concerns related to the use of the developed services from the perspective of potential users. This first survey in the user acceptance task considers (as shown in the figure) preferential and biographical factors of the respondents which are expected to affect the acceptance of the service. The second user survey (shown on the path between "assess experience" and "design feedback") will be part of the trial runs at the pilot sites, addressing the requirements and concerns of potential users after gaining their first experience with the service by participating at pilot site demonstrations.

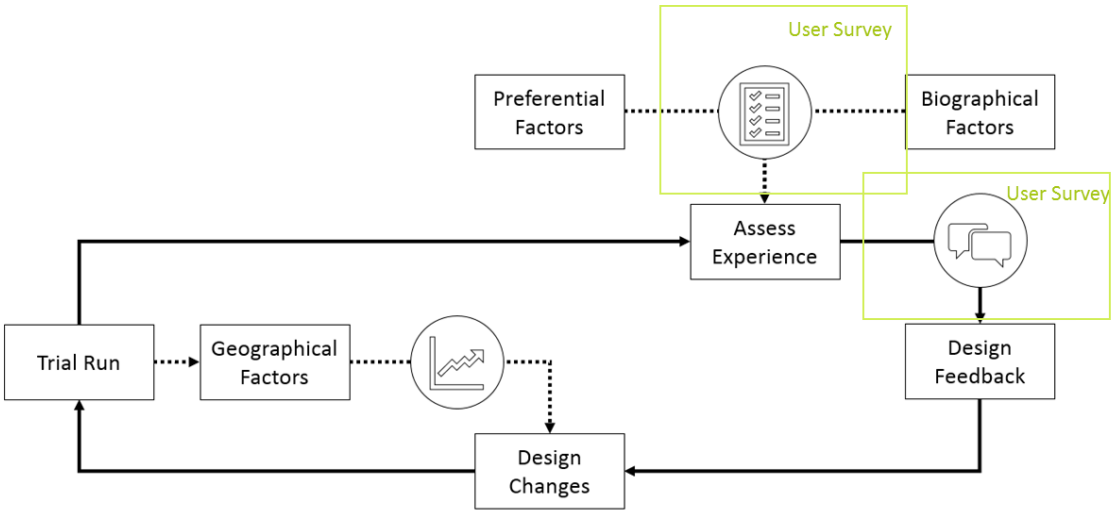



**Figure 1: User Acceptance evaluation concept**

Many studies on user acceptance in the context of automated and connected driving are based on theoretical approaches on acceptance of new technologies, such as the Technology Acceptance Model (TAM) developed by Davis (1985) and the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003). This survey is not directly based on this approach. However, it is in line with its main concepts, which suggest that user acceptance (in terms of willingness to use a service or function) is determined by evaluation of the usefulness and the ease of use of the technology. Following this approach, in the survey we identify functions or features of services that use IoT which are desirable for the users and which are the main concerns or acceptance barriers related to them.

The authors of the present study, however, decided not to use standardized instruments to measure user acceptance, as the user acceptance evaluation in the project "AUTOPILOT" is based on an approach which considers potential users of the developed services as co-designers rather than study subjects. Although the evaluation of usefulness and ease of use from the respondents' point of view was also considered, the main focus of the survey was to address requirements, expectations, concerns as well as suggestions for further development of the service based on the user evaluation. Therefore, instead of asking people how they like the service, we asked which service functions are relevant for making the service more attractive. This approach allows for more practical insights on preferences and acceptance of users than addressing general preferences and factors affecting acceptance.

**In summary, the assessment focusses on how services can be developed in a way to be perceived as useful and easy to use from a user perspective.**

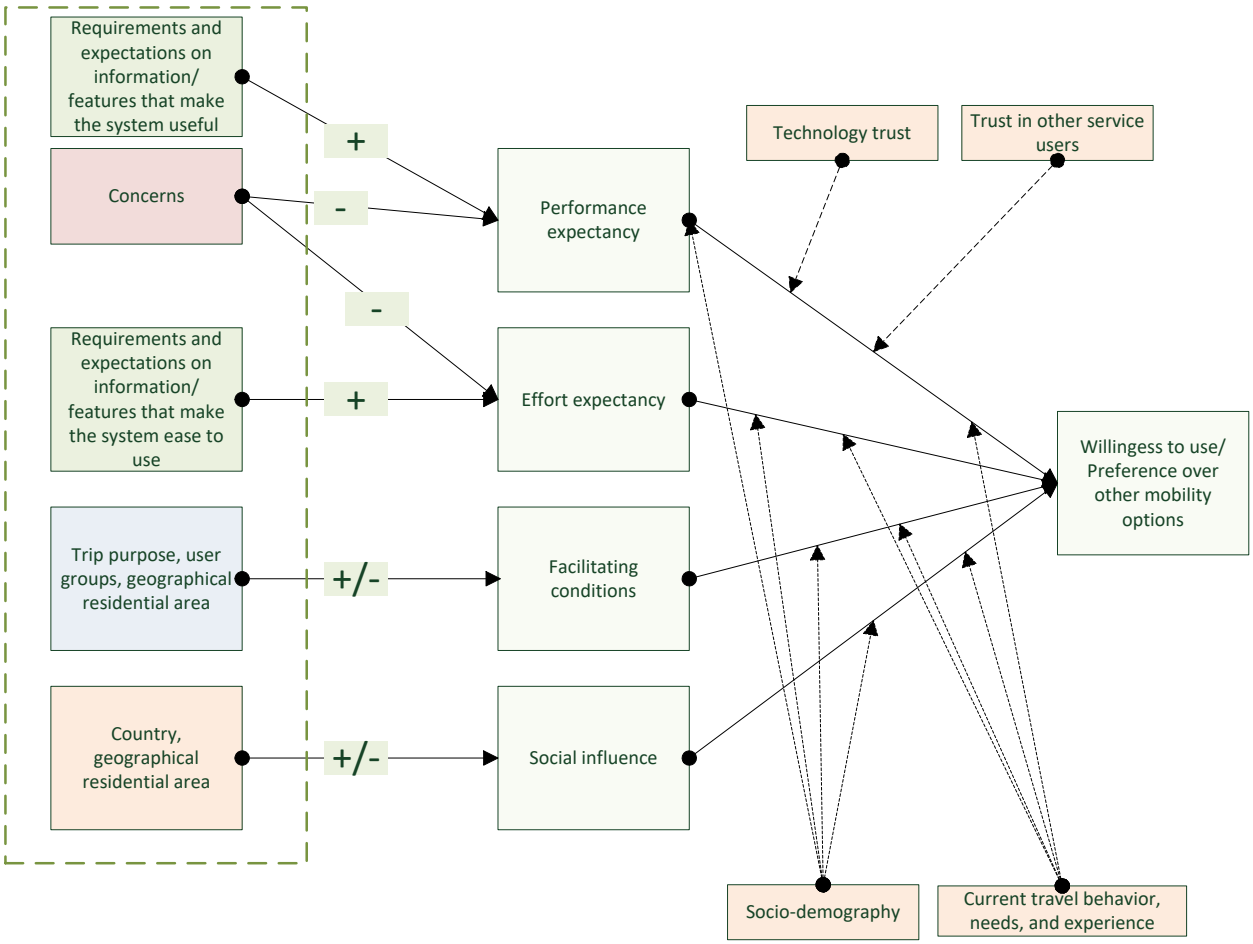



**Figure 2: Combining the UTAUT and the proposed participatory approach**

## Short descriptions of the factors derived from Venkatesh et al. (2003) and Osswald et al. (2012)

*Performance expectancy:*
In the UTAUT, performance expectancy is defined as "the degree to which an individual believes that using the system will help him or her to attain gains in (job) performance."

In CTAM as " the degree to which a driver believes that using the system will help him or her to reach goals in driving performance. We understand driving performance as one's individual goal completion during a car trip. This either can be a global goal like to reach a destination safely, spend less fuel or energy, or a task-related goal like to use an information system in a way that it allows for an efficient and effective task completion."

In the context of AV progressed using an IoT, the performance expectancy is related to the expectation of the user that the function or service will support him/ her to reach his/ her goals in driving performance, i.e., provides him/ her certain benefits when using it.

*Effort expectancy:*
In the UTAUT, "Effort expectancy is defined as the degree of ease associated with the use of the system." In the context of AV progressed by IoT, the effort expectancy is related to the perceived ease of use of the function or service from user perspective.

*Facilitating conditions:*
In the UTAUT, "Facilitating conditions are defined as the degree to which an individual believes that

an organizational and technical infrastructure exists to support use of the system." (including " aspects
of the technological and/or organizational environment that are designed to remove barriers to use").

In the CTAM, "Facilitating conditions are defined as the degree to which an individual believes that a technical infrastructure (like a help menu) or somebody (like a front seat passenger) exist to support in the use of the system."

*(Social influence):*
"Social influence is defined as the degree to which an individual perceives that important others believe he or she should use the new system." In the context of AV progressed by IoT we did not directly address the social influence on decision for using the service.

## 4.2 Research Questions and Hypotheses

The present analysis addresses the requirements, concerns and expectations of potential users of the developed services with view on acceptance and trust. The main research question of the evaluation is how IoT might enable, accelerate and/ or enhance automated driving and the usage of services around automated driving. Thus, the study focuses on the consequences of IoT enabled functions for the users and how users perceive the added value of additional information provided through an IoT enabled service. As we assume that the added value of IoT can only be evaluated by analysing the users' perspective on concrete service features, we address which of these features and/ or functions are relevant from the user point of view.

The hypotheses that were tested had in general an explorative nature. We assumed that an IoT connection will accelerate the use of the service and might enhance the user experience by providing additional features and information.

We analyze, therefore, on the one hand which types of information are required by the users when deciding to use the service and during the operation (especially during using a vehicle in a self-driving mode). On the other hand, study participants were asked which concerns they might have when using the service. Finally, respondents were asked to evaluate the overall scenario and express their expectations related to different parts of the scenario.

Based on the participatory approach described above, the following high-level research questions were identified:

1. What is the **performance expectancy** regarding the service or system?
    a. What are the **requirements** of potential users regarding the **usefulness** of the service or system?
2. What is the **effort expectancy** regarding the service or system?
    a. What are the main **expectations** regarding the **ease of use** of the system?
3. What are the **facilitating conditions** for the success of the service or system?
    a. What is **important** for users when using the service or system?
    b. What are the main **concerns** for users when using the service or system?

**<u>Scenario A "Carsharing as a touristic experience"</u>**

In Use Case A, the user is a tourist who can use a car sharing mobile app to tour in the city and the Gardens of Versailles. At the Gardens, the tourist can experience an automated drive and receive

information about the Gardens (Points of Interest, PoIs). These AUTOPILOT technologies aim to offer a seamless touristic experience through car sharing, infotainment and automated driving. The hypotheses had, as mentioned above, an explorative nature. We focused at the different stages of the developed story on requirements, concerns and expectations of the potential users which would make using the service desirable, easy to use and useful by features or information provided by the IoT connection. The story represents in a way the user experience journey from booking the service to returning the vehicle to the station (see next repot chapter for detailed description of the presented story).

**Scene 1: Considering the use of the service**

In the first stage of the user experience, the potential user has to book the service. At this stage we were interested in which of the following information related to the booking of the service and planning of the usage was required by potential users:

- location of the pick-up station,
- availability of the vehicle,
- availability of a free spot at returning station,
- touristic information notifications,
- estimating wait time in case of vehicle unavailability
- information on available alternatives including a touristic bus, walking and cycling in the city
- congestion on the planned route, personal data requirements
- instructions on how to use the service and customer service support

These requirements are related to desirable features of the service and to performance expectancy.

At this stage we were also interested in concerns from user perspective which are relevant when considering using the service. Here again, we focused on the analyses of concerns related to the data exchange and hence to IoT functionality of the service including:

- data privacy,
- cyber security,
- reliability of information,
- payment security
- concerns related to the effect of using the service on the use of other services/ features, in particular influence of the service on smartphone battery

**Scene 2: Automated driving experience with PoIs notifications**

In the second part of the user experience journey, the users have the option to ride fully autonomously in the Gardens of Versailles and receive touristic information on different points of interest enabled due to the use of IoT.

In this phase we looked into which of the following information and features are required by potential users:

- real-time location,
- PoIs notification and touristic information
- information on the vehicle behaviour (e.g. braking, turning direction, route choice)
- information about detected VRUs (cyclists and pedestrians)

Again, also potential concerns were addressed including the following aspects:

- making pedestrians and cyclists uncomfortable when riding autonomously
- safety concerns, including automated vehicle malfunctioning, incorrect data and/ or data loss

Additionally, at the end of the survey, we collected information on socio-economic data, current

travel behaviour and stated future use of the service in order to analyse the potential of the service for different user segments. The analyses in this report won´t go too deep into these aspects. However, the data will be used for future analyses for scientific publications.

**Scenario B "Platooning"**

In the use case B "Platooning", we suggest that different types of information will be required by the users depending on first, whether the user is a platoon leader or follower and second, the stage of usage. Again, in the next part of the report we have described the presented scenario in more details.

**Scene 1: Considering using the service and booking the service**

For all platoon participants, we have analysed which of the following information and features are required when considering the use of the service and booking it:

- characteristics of the service for the trip is required including cost, travel time, emission savings
- general requirements on the service related to the available alternatives including other options for reaching the destination and other platooning options available
- information about the personal data required when using the service
- information related to the usage of the service is required including number of people using the platoon and current traffic situation on the route

From the platoon leader perspective, we were interested in the evaluation of the importance of different benefits from using the service including:

- time savings and comfort (priority lane use)
- monetary gains (receive money for leading the platoon, other incentives) vs. costs (part of concerns)

From the platoon follower perspective, we were interested in the evaluation of the importance of the following potential benefits from using the service including:

- time savings and comfort (priority lane use)
- don´t have to drive *(riding autonomously option when being a follower in the platoon)*
- ability to perform other activities *en*-route

Again, from follower perspective we were also interested in the information about the platoon leader required by potential users including:

- real-time location,
- contact details,
- previous platooning appointments,
- car characteristics

We suggest that this information would also affect the concerns or trust-related issues.

Regarding potential concerns related to the usage of the service, we had asked for evaluating the following one:

- concerns related to data use including data privacy, cyber security, reliability of information, reliability of connection between the
- concerns related to the effect of using the service on the use of other services/ features, in particular influence of the service on smartphone battery
- concerns related to the other platoon members including not coming to the appointment, leader not arriving at the predefined destination, leader being not a safe driver, leader not giving his/hers real identity

**Scene 2-1: Driving in a platoon from a platoon leader perspective**

When driving in a platoon as a platoon leader, we were interested in the evaluation of the relevance of the following information from user pe4rspective:

- real-time information due to the IoT connectivity including information on accidents, congestion, weather, platoon status, strength and security of data connection
- information on the road condition including hazards or road works
- suggestions / recommendations depending on the current status of the trip/ platoon including alternative routes, speed, headway between the vehicles, moving out of priority lane
- information about the other platoon members including communication from the other users

While the first two types of information can be related to the performance expectancy from user perspective, the last two aspects are rather related to information and features which can make using the service easier for the platoon leader.

Regarding potential concerns when being a platoon leader, we addressed the following aspects:

- data privacy,
- cyber security,
- reliability of information,
- reliability of connection between the vehicles
- responsibility/liability for the safety of platoon followers,
- technical failure of the following car,
- the user of following car can decide to disconnect

**Scene 2-1: Driving in a platoon from a platoon follower perspective**

From the follower perspective, we were interested in the evaluation of the relevance of the following information:

- information about the leading car including information on what the leading car is doing and why
- information about the own car including information on what the car “sees” or is doing
- real-time information due to the IoT connectivity including information on congestion, estimated time in self-diving mode, strength and security of data connection, and status of the platoon

Potential concerns of the platoon follower that we look at are again:

- data privacy,
- cyber security,
- reliability of information,
- reliability of connection between the vehicles
- potential technical failure of the leading car,
- another user detaching from the platoon

Also:

- concerns related to the leader including unsafe driving style
- concerns related to the self-driving technology

Additionally, we looked into requirements of the follower in a platoon including:

- information about the leader such rating from other users
- suggestions or the ability to take back the control in case of emergency

**Scenario C “Automated Valet Parking”**

The focus of Scenario C is Automated Valet Parking. Using the service, a user can drive to a drop-off station in front of a building where the service is available (such as a shopping centre or company building), get out of the car and the car can drive to an empty space and park by itself within a designated parking lot. The user requests a parking space using a dedicated smartphone app, which connects to the parking management system cameras (fixed and aerial drone) to identify a free space. The car is returned to the user when requested to through the app.

In this scenario, we asked potential users to evaluate the relevance of the following information and features when using the automated parking function:

- real-time car park location and space availability
- location and choice of space
- real-time location and intended route of the car whilst parking and parking status
- customer service contact
- Identification of objects detected by the car
-

Also, the importance of the following potential concerns from user perspective was evaluated:

- data privacy,
- cyber security,
- system reliability
- potential automated vehicle malfunctioning
- incorrect data and/ or data loss

## 4.3 Indicators and Metrics

The survey addresses expectations, requirements and possible concerns of potential users. Since a core function of the Internet of Things is the exchange of information between connected devices, the current study focusses on the relevance of different types of information provided by the service from the users' point of view. Regarding the concerns related to the use of the service, different aspects were addressed, including data privacy and cyber security issues as well as perceived trust in the performance of the technology and the correctness of the information provided. For the measurement of the information required by the users, a Likert scale from 1 = *"very relevant"* to 7 = *"irrelevant"* was used. For the measurement of the perceived concerns related to the use of the introduced services, a Likert scale from 1 = *"not concerned at all"* to 7 = *"very concerned*" was used. Using a seven instead of a five-point Likert scale allows for the assessment of more detailed differences between respondents.

The online survey introduces different scenarios of using automated driving enhanced with IoT. Respondents can choose which scenario to answer. All scenarios are introduced using a short story and pictures. The storyboards were designed following the pilot plans developed by the project partners. However, the story has been modified in order to make it easier to understand by the respondents of the survey.

Figure 2 provides a schematic overview of the structure of the online questionnaire. On the first page of the survey, respondents could choose the language for the survey. The survey was translated in 8 languages (for more on this, see 4.4. "Data Collection"). On the second page, a short introduction of the task was provided, followed by a brief overview of the scenario. On the following pages, specific parts of the scenario were introduced followed by questions related to these parts. The scenario descriptions as well as all questions are presented in Annex 2. All scenario descriptions follow the stories summarized in the Pilot Plans. However, in order to simplify them, we concentrated on less technical details and adjusted the stories in order to make it simple and understandable for the participants. The scenarios are described in section 5 "Selected scenarios" of this report. After

finishing the description of the scenario, there were general questions related to the evaluation of the whole scenario. On the last page, the respondents were asked to report some general information about themselves, such as socio-demographics, their mobility behavior as well as their experience with advanced driver assistance systems and topics related to the Internet of Things.

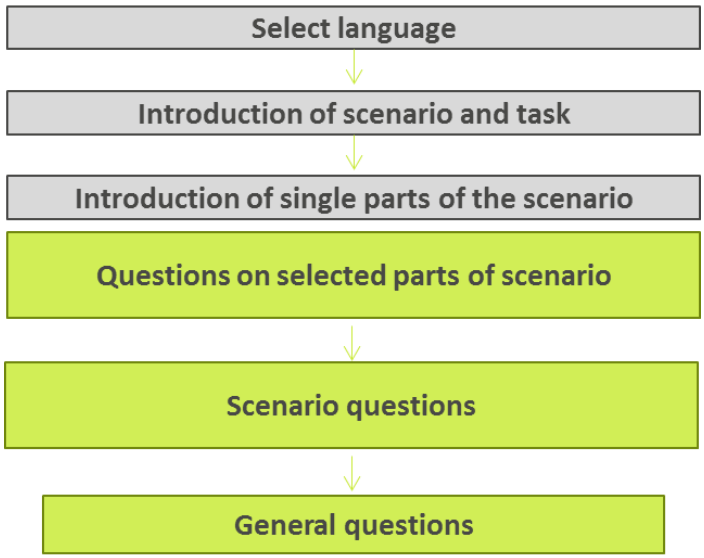



**Figure 3: Structure of the questionnaire**

## 4.4 Data Collection

The online survey was conducted in the following eight countries: UK, Germany, France, Italy, Spain, Netherlands, Greece, and Finland. The countries were selected to represent different European countries as well as to cover the countries where most of the project partners come from. The questionnaire was implemented in an online form provided by the company "LamaPoll"[1].

For the recruitment of samples, a professional service provider (respondi AG[2]) was used. All purchased samples were representative by age and gender in the selected countries and for each scenario. This ensures more reliable results from the survey giving a broader overview on user preferences that belongs to different age and gender groups. The sample size was n= 200 persons per country for the first two scenarios (total n=1600 each) and n=100 for the third scenario (Automated Valet parking, total n=800).

In the first version of this deliverable, however, only the results from the representative survey are presented. The survey for the general public will be launched at a later time in the project. The deliverable will therefore be updated with the data from the public survey at a later point in time.

## 4.5 Study sample

In this part, the samples in all three surveys (scenario A, scenario B, and scenario C) are presented using the results of the analyses of socio-demographic and other respondent-related characteristics, such as mobility behavior and experience.

An overview of the samples' socio-demographic characteristics by country (age and gender distribution) provided by the professional provider is presented in Figures 3 and 4. The statistics for

[1] *https://www.lamapoll.de/autopilot/*
[2] https://www.respondi.com/

the representative share of people by age groups were derived from EUROSTAT statistics.

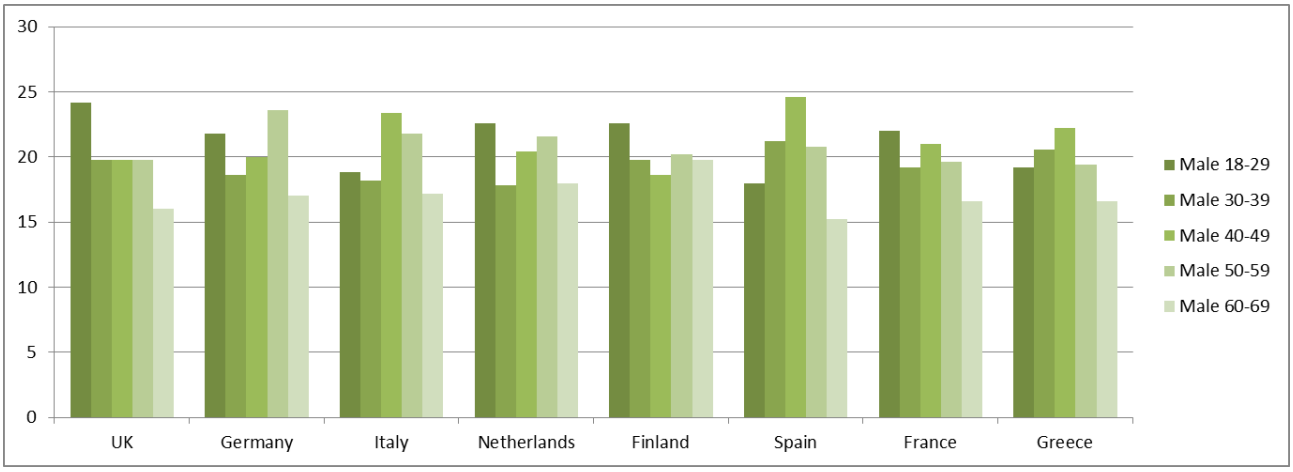



**Figure 4: Share of men by age groups for each country [%]**

The descriptive analyses of other characteristics of the respondents, such as their mobility behavior or relevant experience, can be found in the annex of this report.

# 5 Evaluated scenarios

As mentioned above, the scenarios follow the storylines summarised in the Pilot simplifying them in order to make them more understandable for the participants. Note that not all use cases developed and tested in "AUTOPILOT" were considered. The user acceptance task selected only scenarios where IoT plays a crucial role in the service presented.

In this first version of the deliverable, only Scenario A: Carsharing as a touristic experience is addressed. Thus, only this scenario is analysed in detail in this version of the report.

## 5.1 Scenario A: Carsharing as a touristic experience

Scenario A addresses a carsharing service for tourists that will be developed and tested in Versailles, France in the framework of "AUTOPILOT". Following the detailed storyline provided by the project partners involved in the French pilot site, the evaluation team developed an adjusted and simplified short introductory story about a tourist visiting Versailles during his holiday. The storyline has the following parts:

***Short overview of the whole scenario:***


*"Versailles is a city just outside of Paris, France renowned worldwide for its historic palace and beautiful gardens, both of which are UNESCO World Heritage Sites. The Palace of Versailles is a very popular tourist attraction, receiving millions of visitors each year.*

*A new service is being introduced in Versailles, which offers tourists a new way to experience the city and its attractions. Visitors now have the opportunity to tour the city using small vehicles which can be driven manually or, on certain routes, can be driven around automatically by the vehicle itself.*

*These vehicles can be reserve using the new smartphone app "AUTOPILOT". Once a reservation has been made, all that is needed is to collect the vehicle at a car sharing/ pick up station and then visitors can drive along 6 km route around the city. In the Palace Gardens, there is a predefined, fixed route of 2 km, where the vehicle drives by itself."*

***Scene 1: Preparation and booking the service/ a vehicle:***

*"Today John is visiting Versailles. He has heard about the new service for tourists and has decided to try it out. He downloads the "AUTOPILOT" app, chooses his language (English), and creates an account.*

*Using the app, John chooses one of the pick-up stations and reserves a vehicle. The app shows him the route to the station where the reserved vehicle is waiting for him.*

*John arrives at the station. The app indicates the reserved vehicle's license plate number and parking lot number. He unplugs the vehicle from the station and opens it using the app. He then gets into the vehicle.*
*John is now ready to start his trip."*

***Scene 2: Autonomous driving in Versailles Gardens***


*"John wants to visit the Versailles Gardens, so he selects the destination on the "AUTOPILOT" app. The app helps him navigate and John drives the vehicle to the entrance of the Gardens. From here, the self-driving mode is activated, and the vehicle takes over the driving task. There is no motorised traffic in the Gardens, but the self-driving vehicle is allowed to drive on the paths along with pedestrians and cyclists.*

*The route through the Gardens is fixed, about 2 km long and with the vehicle travelling at around 15 km/h it takes roughly 20 minutes. The vehicle is self-driving, so John does not have to worry about taking the wheel and can admire the Gardens in peace. Using its sensors and cameras, the car gives way to pedestrians and cyclists. The vehicle arrives near a point of interest.*

*A notification shows up on screen and a voice message says: "We are in front of the Lake of the Swiss Guard. Would you like to know more about it?" John says "Yes". Now the vehicle stops and he can choose whether he wants to listen to an audio message or to watch a short video (about 1 minute) about this point of interest."*

***Scene 3: Returning the vehicle:***

*"The automated vehicle continues along the route, passing other points of interest in a similar way, until it reaches the exit of the Gardens, at which point the self-driving mode ends. John starts driving again and the AUTOPILOT app guides him to the vehicle drop-off station. John parks the vehicle and leaves. After returning the*

*vehicle, a trip summary is displayed on the app (duration and distance of the trip). John can now rate his experience."*

## 5.2 Scenario B: Platooning

Scenario B addresses a platooning service which will be developed and tested in Helmond, Netherlands in the framework of "AUTOPILOT". The scenario presented in the online survey introduces the service with the example of two fictive persons who live and work in Helmond and make an appointment to drive from Helmond to Eindhoven in a platoon.

***Short overview of the whole scenario:***



*"Helmond is a city in the Netherlands, located about 15 km from Eindhoven. To travel from Helmond to Eindhoven by car can take between 20 and 60 minutes depending on the traffic situation on the highway.*

*A new service has been introduced in Helmond, offering people with the same destination to drive together in a so-called "platoon". A platoon is a formation of cars travelling together as a group at a close distance to each other – one car leads the group and the other cars follow it. The cars in the platoon have to have special equipment which enables them to communicate with each other. In our case, the leading car is driven manually, while the following cars drive in self-driving mode. The platooning is available in this case only on the highway. Cars, which drive in a platoon, can use a priority lane on the highway, which can reduce their journey time.*

*The cars connect into a platoon prior to entering the highway and stay connected throughout the duration of the highway journey. The new service uses the smartphone app "AUTOPILOT" which enables users to enter their routes and find other people with the same itineraries. Users can choose either to create a new platoon and lead the other cars or to join an existing one."*

***Scene 1: Preparation and booking the service/ a vehicle:***


*"Bart and Wendy both live and work in Helmond. Let´s see how the service works with an example of a trip they are both taking to Eindhoven.*

*Today, Bart needs to drive from Helmond to Eindhoven for an appointment. He has heard about the new service and decides to try it out so he can use the priority lane on the highway. He enters his destination into the "AUTOPILOT" app and enables the option for platooning. The service searches for other user(s) with a similar route who want to join the platoon.*

*Wendy also needs to go to Eindhoven to meet a client. She checks on her "AUTOPILOT" app if someone else is looking for platooning too, and receives the option to join Bart´s platoon. She confirms the match with Bart and chooses a location on her route where they can meet for the platoon formation."*

***Scene 2: Driving in a platoon***


*"Everything worked well with the platooning appointment. Bart and Wendy are travelling on the highway using the priority lane. Bart is driving the leading vehicle, while Wendy´s car is following in self-driving mode.*

*The cars in the platoon as well as the service users´ smartphones are constantly exchanging information with each other and with elements of the infrastructure, such as traffic lights, the traffic management centre or the weather station. To achieve this, the cars need some equipment, such as internet access. This allows the cars for example to communicate about how to form the platoon and warn each other in case of unexpected events.*

*Wendy´s and Bart´s cars both have this equipment. Also, their smartphones are connected with the car communication system. Hence, the information which is received via the app "AUTOPILOT" is also shown on a display in the car and vice versa.*

*In our story, Bart has just received a message from the traffic management centre on the "AUTOPILOT" app as well as on a display in his car warning him that an accident just happened on his route. A recommendation for him to drive more slowly shows up on the screen of his smartphone via the app, and he responds accordingly.*

*"Bart is in the leading car of the platoon, so he drives manually. Wendy is in the car that follows Bart´s car, so her car drives in self-driving mode. Throughout the journey, Wendy can prepare for her meeting with her client. Wendy's car has been warned by Bart's car that it is slowing down and adapts its speed automatically. Wendy does not have to take any action."*

***Last scene***

*"Wendy and Bart safely reach Eindhoven and leave the highway. As platooning is only available on the highway, from here the platooning ends. Wendy resumes control of her car and both Bart and Wendy drive independently. Then, Wendy and Bart drive to their final destinations. Because they used the service, which allowed them to drive efficiently and use the priority lane, they reached their destination quicker and at lower cost and emissions than if they travelled independently*."

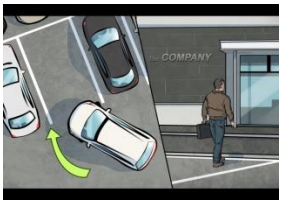
## 5.3 Scenario C: Automated Valet Parking

Scenario C addresses an automated vehicle service which will be developed and tested in Helmond, Netherlands in the framework of "AUTOPILOT". The introduced story focuses on the use of the service with the example of a fictive person who has an appointment by a company on whose parking place the service is available. The story presented and evaluated in the survey describes how the service works.

***Short overview of the whole scenario:***


*"A new parking service has been introduced in several places in the city of Helmond in the Netherlands, allowing people to access an automated valet parking. Using the service, one can drive to a drop-off station in front of a building where the service is available (such as a shopping center or company building), get out of the car and the car can park by itself within a designated parking lot."*

### *Booking the service and parking the car*


*"Bob lives and works in Helmond. Let´s see how the service works with the example of Bob´s first experience with it. Bob has heard about the new parking service and wants to try it. Today Bob has a business appointment at a company in Helmond where the new service is available, so this is his chance to try it out. He has already downloaded the app "AUTOPILOT" which enables him to use the service.*

*Bob drives to his destination and stops at a drop-off station in front of the company´s building at the Automotive campus where his appointment is. He gets out of the car and sends a request for automated valet parking using his app. The app connects to the parking management system to check for a free parking spot in the campus parking lot.*

*Today is a very busy day at the Automotive campus because of a large congress. The parking management system checks the current status of the parking spots using the dedicated cameras in the parking lot and finds that all spots visible for the cameras are reported as "occupied".*

*The parking management system seeks the assistance of drones that are employed to support automated valet parking, as the management system estimates that there are still parking spots available. At the request of the parking management system, the drone starts searching for a free parking spot.*

*The drone sets off its flight and finds some free parking spots that were not clearly visible to the dedicated cameras and informs this to the parking management service. The parking management system now assigns a free parking spot to Bob's car and sends Bob this information. Bob accepts the suggested parking spot and sends his car to park using the app.*

*Bob doesn't have to take care of the parking and goes to his appointment. His car drives automatically to the dedicated parking spot to park by itself. The car usually takes the shortest route to the parking lot. But today the access road to the parking lot is blocked by a truck of the waste management system of the city trying to empty the waste containers. The parking management system provides an alternative obstacle free route to Bob's car. Bob's car takes this route and drives in automated mode into the parking spot."*

***Picking up the car***


*"At the end of his meeting, Bob uses his smartphone and the "AUTOPILOT" app again to retrieve his car. The car drives automatically from the parking lot to the pickup point."*

# 6 Results

This section summarizes the main results for scenario A "Carsharing as a touristic experience" followed by a general discussion of the results.

## 6.1 Scenario A: Main results

### 6.1.1 Requirements

6.1.1.1 Information required before using the service

After Scenario A was introduced, participants were asked about the types of information they considered relevant for the users in the booking phase up to entering the vehicle. The question aimed to assess, which information is required by the potential users of the service. Eleven answer options were given, and the participants were asked to evaluate the relevance of each option. A seven-point scale starting from *1 =very relevant* to *7 = irrelevant* was used. Information which is evaluated from 1 to 3 is interpreted as highly relevant to relevant according to the respondents. Information provided by the service which is evaluated with the values 5 to 7 is interpreted as not that relevant and up to irrelevant from the respondents´ point of view.

Eleven answer options were given, and the participants were asked to evaluate the relevance of each option. An overview of the results from the whole sample (all countries, Figure 5) shows that respondents consider all types of information presented in the question as relevant to some degree – a minimum of 71% of the respondents rated the aspects on a 7-point scale between 1 (= *"very relevant")* and 3, 49% rated with 1 or 2. Information most rated "very relevant" was information about the availability of a vehicle (53 % of respondents), followed by instructions on using the service (49 %). Slightly less relevant than the mentioned aspects are the following types of information: estimated waiting time in case that no vehicle is currently available, the route of the tour, availability of a free parking space at the return station, and contact information for customer service. Here again, all mentioned types of information address ensuring the easy use of the service but are also related to a more detailed planning of the service usage including also the route of the tour and the return of the vehicle. The information about restaurants, hotels and cafes was rated to the least extent relevant by a small margin.

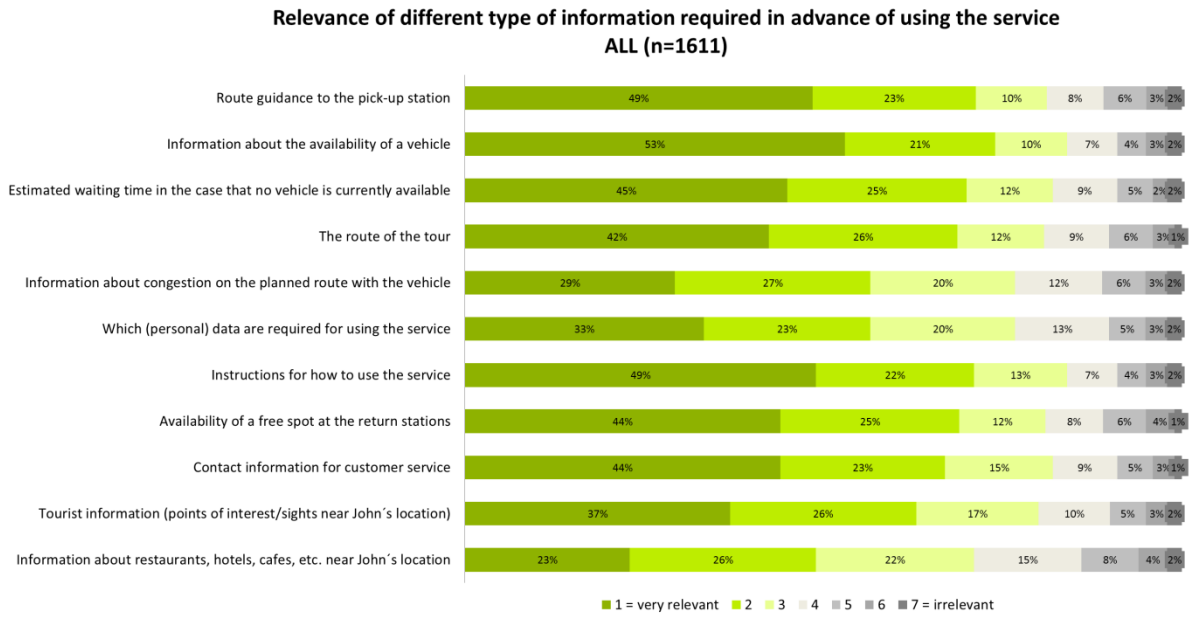



**Figure 5: Relevance of different types of information in advance of the usage**

### 6.1.1.2 Information required during operation

The second question, which addresses the relevance of different types of information provided by the service, has a strong focus on the information required during operation, i.e., when riding in the vehicle in automated mode. This question had five given answer options, some of which were the same as in the previous question (relevance of information in the booking phase).

Real-time tourist information is evaluated by most of the respondents (66%) as (very) relevant when using the service in the Gardens, which is not surprising considering the main purpose of the introduced service. Information related to the automated driving function and contact information for the customer service is evaluated as almost equally relevant at this point. Furthermore, these types of information are evaluated as relevant (mostly with values between 1 and 3 on the 7-point scale), even if only about one third of the respondents evaluated it as *"very relevant"*. Thus, providing people with information about the operation of the vehicle might increase the perceived safety of the service and/ or satisfy their desire to oversee the vehicle operation while driving in a self-driving mode.

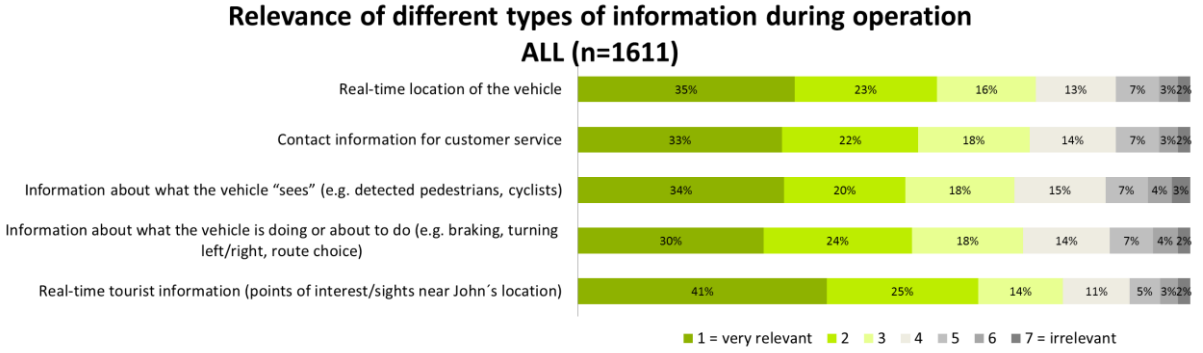



**Figure 6: Relevance of different types of information during operation**

### 6.1.1.3 Requirements on other features

To assess the respondents' thoughts regarding features enabled by IoT, two types of information were shown and the respondents asked to rate the usefulness of those features (on a scale from 1 to

7, where 1 is useful and 7 is useless).

From the results (Figure 7) it can be seen that both types of information are assessed useful (answers 1 to 3) by at least 61 % of respondents. Real-time information about points of interest was rated slightly more useful (and less useless) than information about the position of pedestrians by using their smartphones.

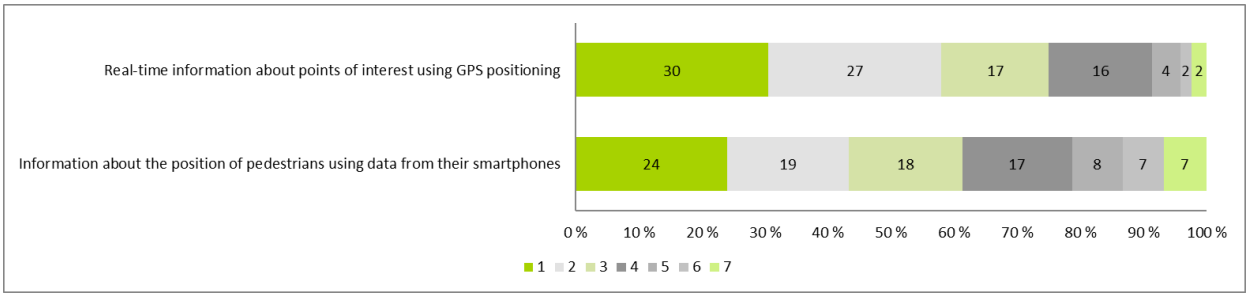



**Figure 7: Usefulness of information provided on a scale of 1 (useful) to 7 (useless)**

### 6.1.2 Concerns

#### 6.1.2.1 Concerns in advance of using the service

Respondents were asked to which extent users would be concerned or not concerned when booking the service. There were five given options to rate and a possibility to add their own concern as an open answer.

Participants were given a choice of a 7-point scale reflecting the level of concern where 1 represented *not at all concerned* and 7 was *very concerned*.

From the results (Figure 8) it can be seen that the given options were rated in a similar way: the rate of concern (options 5 to 7) varied from 40 % to 51 %, and the rate of not being concerned (options 1 to 3) varied from 31 % to 36 %). The option with the most respondents choosing “very concerned” was highest regarding the payment process for using the service (19 % “very concerned” compared to 9–14 % for the other given options).

There were similar share splits between the levels of concern for all aspects except ‘other concerns’. The other concerns cannot be compared directly with the specific aspects as the concern being scored varies between respondents. For each specified aspect less than 10% of respondents registered that they were not at all concerned, and at least 9% were very concerned.

Less than 10% of the sample had other concerns, and of these concerns there were much higher levels of both *“not at all concerned”* and being *“very concerned”* compared to the other aspects. The most common other concerns raised were getting help in a technical failure or emergency, data connection, usage and cost as well as vehicle safety.

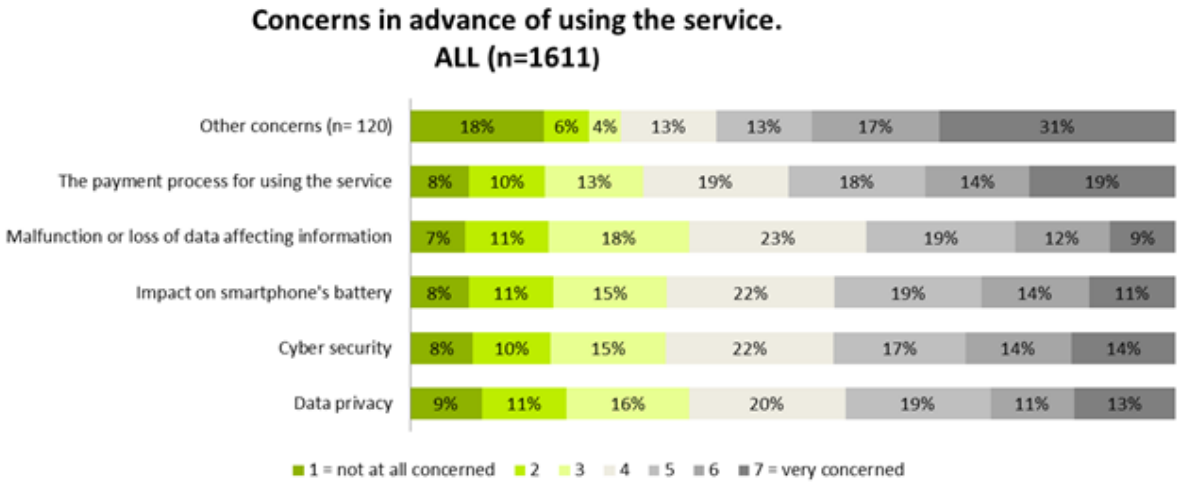



**Figure 8: Concerns in advance of the usage**

#### 6.1.2.2 Concerns about the service during operation

The next question was about the potential concerns of the user in the vehicle, during the trip. This question had three given options and the possibility to add a concern. Also, here the answers are similarly distributed. The rate of concerned responses (options 5 to 7) varied from 37 % to 47 %, while the rate of not concerned responses (options 1 to 3) varied between 23 % and 39 %.

A follow up question to the above asked the respondents to then place themselves in the position of a user and relate what their concerns were. This was more limited than the first question, and focused only on vehicle malfunction, making other pedestrians and cyclists feel uncomfortable and data loss/malfunction affecting information. Similar to the concerns prior to using the service, there is little variation in levels of concern between the three aspects that are proposed, and there is a relatively even spread, with the greatest concerns appearing to be related to the probability of vehicle malfunction and the least concerning aspect being malfunction or loss of data.

Again, less than 10% of respondents registered any other concerns, but almost 50% of these concerns were scored as being very concerning. The main concern was safety of the vehicle, but there were also many concerns about being able to stop the vehicle during the tour if they wanted to linger at a spot, or if they felt ill.

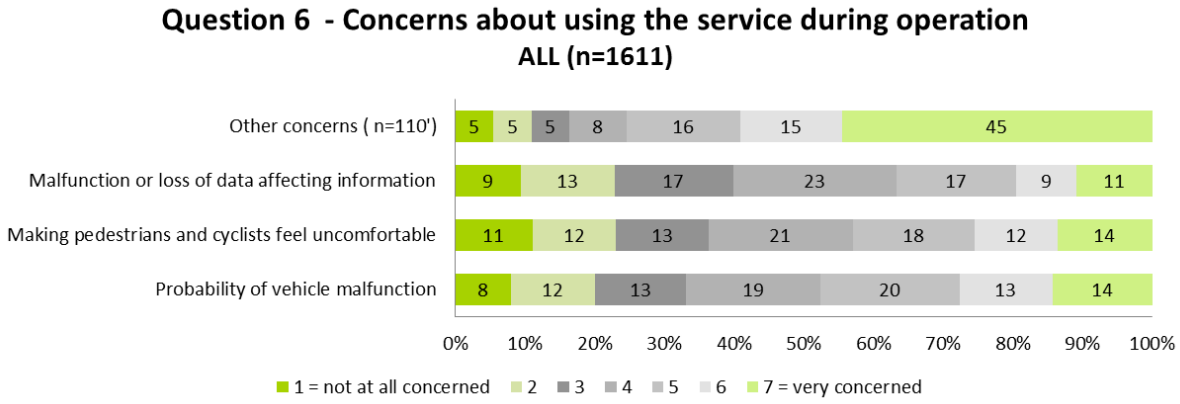



**Figure 9: Concerns during operation**

### 6.1.3 Evaluation of the perceived experience

Next, respondents were asked to evaluate the described scenario as a whole, from booking to returning the vehicle, based on the introduction provided. Overall, participants rated the experience of the trip in Versailles as easy to use (77 % of answers 1 to 3,
Figure 10), safe (66 %), useful (78 %), exciting (70 %) and a positive experience (84 %). The answers are fairly evenly distributed, but safety received the least positive answers and the most negative ones (11 % answers from 5 to 7).

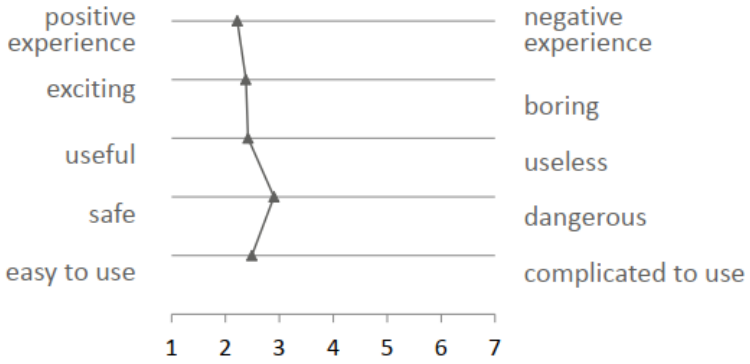



**Figure 10: Overall perceived experience**

### 6.1.4 Willingness to use the service and preferences toward using the service over other travel modes

The next question asked how much respondents agreed with the statement "I would use the service if it was available". In response, two thirds of respondents (66 %) stated they agreed and 18 % stated they disagreed. The overall median was 3 on a scale of 1 to 7, where 1 expresses strong agreement with using the service and 7 strong disagreement.

In order to assess potential for change in mobility patterns, the respondents were then asked to state whether they preferred using the self-driving vehicle if it was available over other options: using a tourist bus in the city, renting a car in the city, walking or cycling in the city, or walking or cycling in the gardens.

Around two thirds of the respondents reported that they would prefer the experience with the automated vehicle over renting a conventional car in the city or using a tourist bus (see Figure 11). Interestingly, almost half of the respondents stated that they would prefer using the self-driving vehicle over cycling or walking rather in the city than in the Gardens. However, this preference has a lower positive score than using the vehicle in the city.

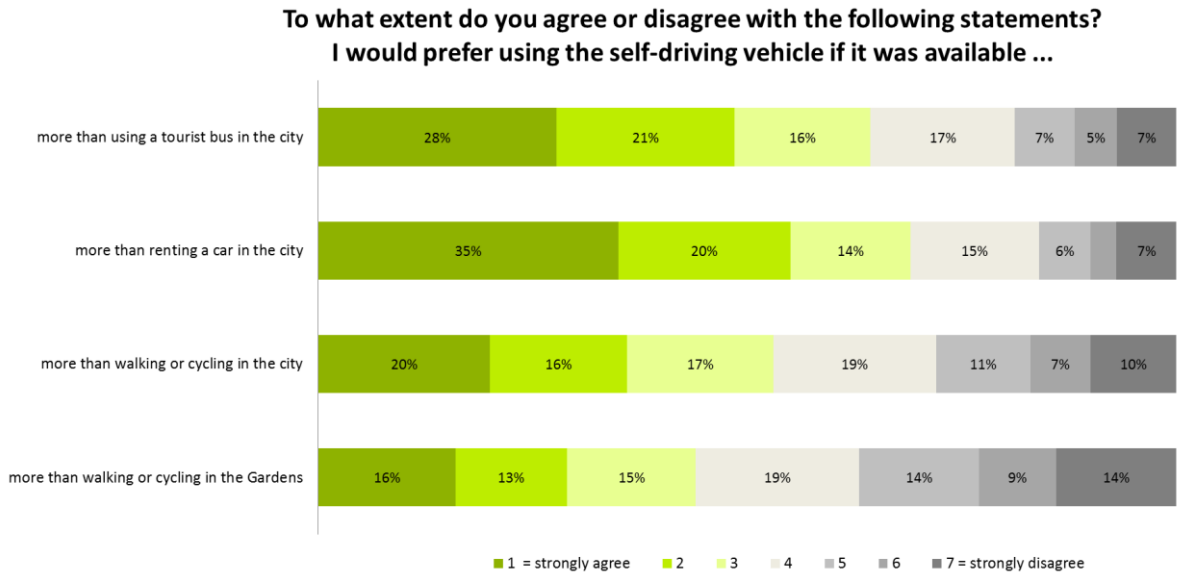



**Figure 11: Preferred situations/conditions of using a self-driving vehicle (n=1611)**

### 6.1.5 User preferences towards service characteristics

#### 6.1.5.1 Preferences towards sharing data to use the service

Respondents were asked whether they would be willing to share different data with the service provider in order to use the service. From the results it can be seen (Figure 12) that E-mail is the most preferred registration method (75%), followed by Name and Surname (66%). Moreover, respondents seem more reluctant to share their bank details (24%) than to use other payment options, such as PayPal (45%). Also, a rather small share of respondents stated to be willing to provide access to the microphone on their smartphone (24%) or to register with an existing account in order to be able to use the service (25%).

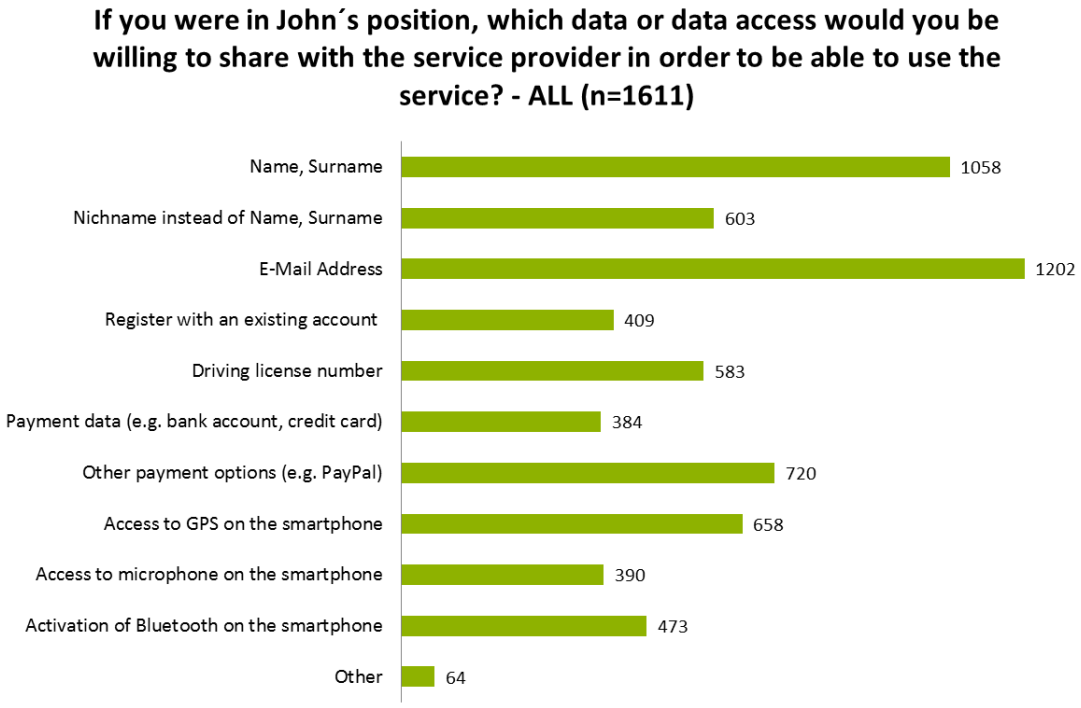



**Figure 12: Willingness to share data – ALL (n=1611)**

### 6.1.5.2 Preferences towards other services provided by the app

The participants were asked of their interest to use the app also for other services than booking the tour in Versailles. More than half (54 % of respondents, Figure 13) stated they would like to use it also for a sightseeing tour without a vehicle, over one third (37 %) stated they would like to use it for other mobility services in Versailles, and 17 % stated they would like to use it also for a similar service in other cities. Almost one in five respondents (19 %) stated they would not like to use the app for any other services.

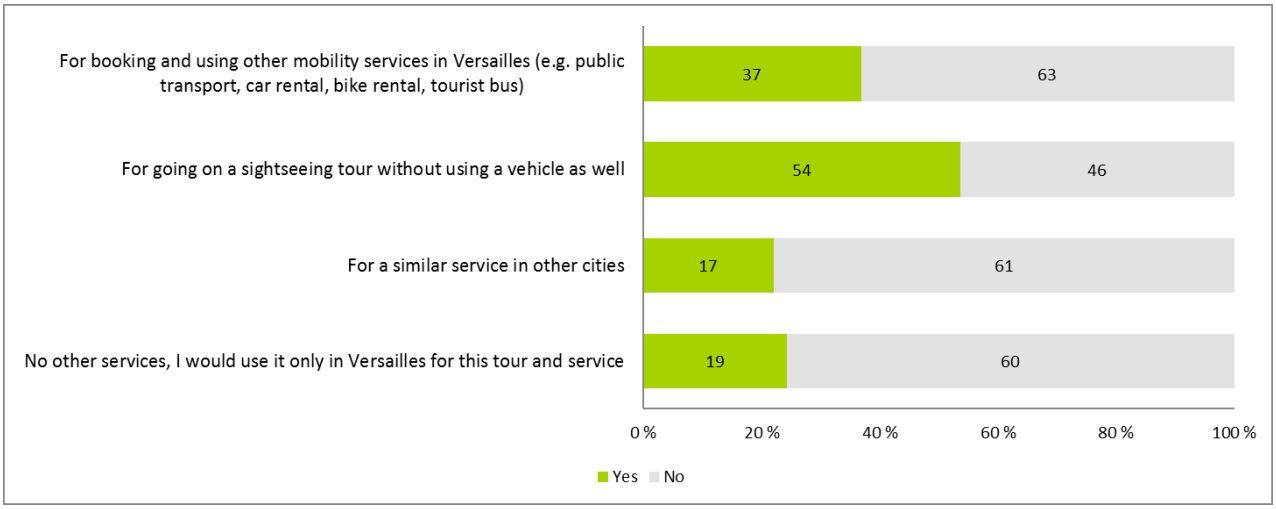



**Figure 13: Other uses for the application**

### 6.1.5.3 Preferences towards pricing models

Next, the participants were asked about their preferred payment types for the trip in Versailles: they were asked to state which option of three they preferred. Across all countries, most of the interviewees (67 %) responded that the most convenient pricing basis for the system is a fixed price for a tour. Almost one in four (23 %) would prefer to pay cost per minute for using the vehicle and one in ten (10 %) preferred having the price of use included in a “tour in Versailles” package, which includes also other mobility and tourist services.

### 6.1.6 Potential user groups

The next two questions addressed the user groups for which the service could be useful. The respondents were asked to choose all answers that applied in their opinion.

Of the respondents, two in three (68 %) considered the service attractive for people with mobility constraints (e.g. disabilities, age-related constraints) and 62 % considered the service to be attractive for tourists travelling in couple, 47 % for individuals and 43 % for travelling families with children. (Figure 14).

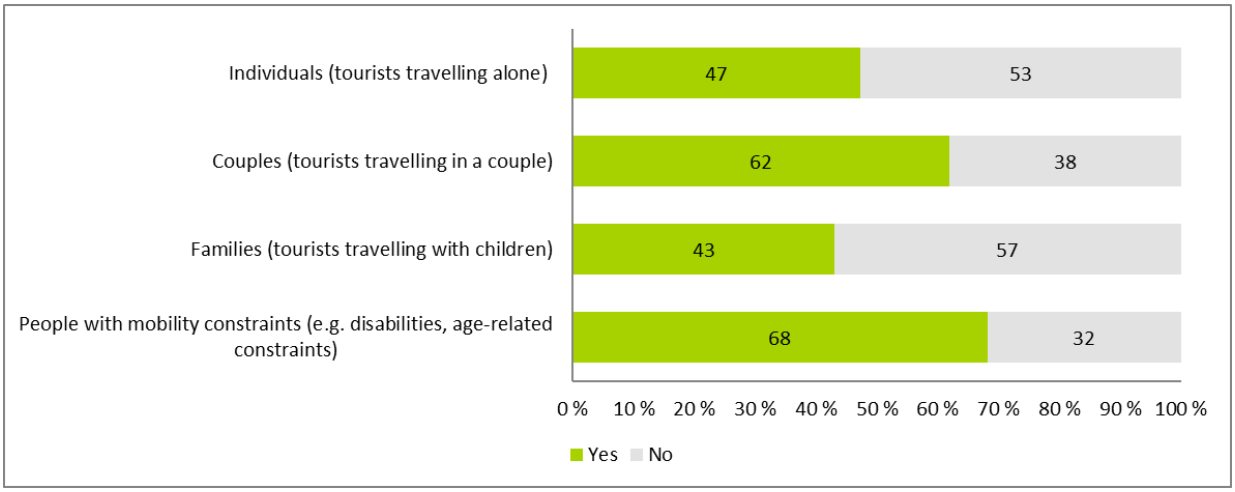



**Figure 14: Attractiveness of service for different users**

Regarding age groups, more than half of respondents found the service useful for age groups between 40 and 69 years (Figure 15). The service was considered least useful for people under the age of 18 (chosen by only 14 % of respondents).

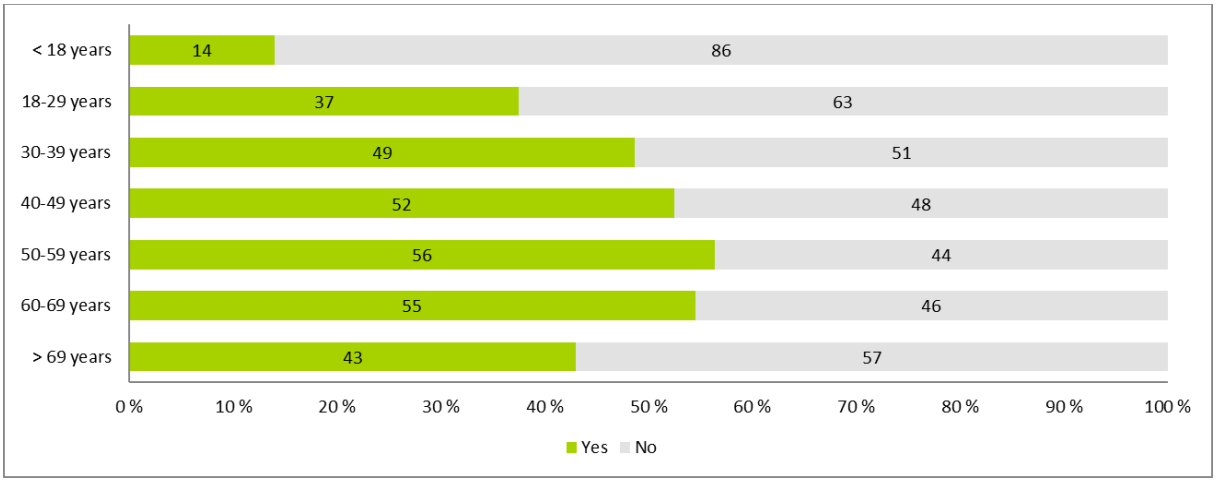



**Figure 15: Attractiveness of service for different age groups**

### 6.1.7 Suggestions for development

As a last question, respondents were asked to provide suggestions on how the service should be developed. The results are summarised in the table below. In total, there were quite many different suggestions. The ones standing out the most were allowing the use of the vehicle also at other locations (other cities, countries or in the centre of Versailles), allowing the user to stop the vehicle when it is in automated mode, to take pictures or enjoy the surroundings, making sure the service is very easy to use for different user groups, and keeping the costs to the users down.

**Table 2: Suggestions on how the service should be developed**

| n | Suggestion |
|---|---|
| 15 | allow use also elsewhere (other locations) |
| 8 | allow for stops |
| 7 | make it very simple to use or provide extra simple version (elderly, disabled) |
| 7 | keep costs down |
| 6 | add information on other locations (restaurants, relaxing areas, wc) |
| 6 | ensure safety |
| 5 | allow use/detection also without smartphone |
| 3 | show estimated time |
| 3 | use separate paths/lanes for AV |
| 3 | allow for group bookings, ride sharing |
| 3 | cooperate with tourist offices |
| 2 | remove need to drive manually |
| 2 | use electric vehicles |
| 2 | include emergency option |
| 2 | allow for voice control/assistance |

## 6.2 Scenario B: Main results

### 6.2.1 Requirements

#### 6.2.1.1 Information required before using the service

The participants were again asked about the relevance of different types of information supplied by the service at different stages of its use.

After the first scene of the scenario was introduced, participants were asked about the types of information they considered relevant for the users when considering using the service. Again, a seven-point scale starting from *1 =very relevant* to *7 = irrelevant* was used. Information which is evaluated from 1 to 3 is interpreted as highly relevant to relevant according to the respondents. Information provided by the service which is evaluated with the values 5 to 7 is interpreted as not that relevant and up to irrelevant from the respondents´ point of view.

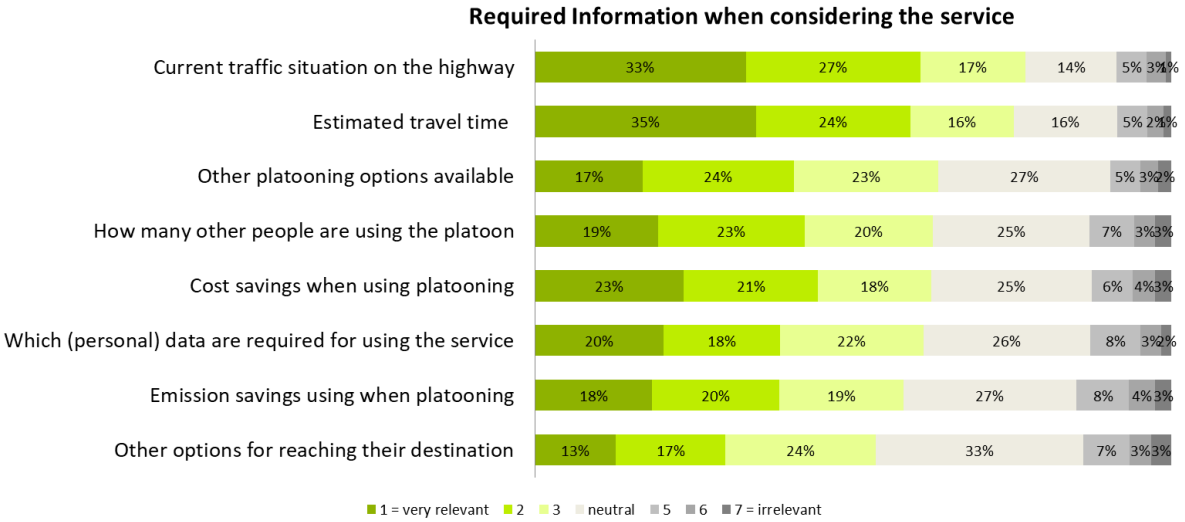



**Figure 16: Required information when considering the service (N=1424)**

The results of the analyses (Figure 16) show that the information prior to the use of the service that was judged to be (very) relevant by the majority of participants is information about the current traffic situation on the highway (60%) and the estimated travel time (59%) while information about emission savings when platooning (38%) and other options for reaching the destination were rated (very) relevant by fewer respondents. Overall, most of the presented information during operation seems to be more relevant to the respondents than those before using the service.

#### 6.2.1.2 Information required before using the service

The second question, which addresses the relevance of different types of information provided by the service, has a strong focus on the information required during operation, i.e., when driving in a platoon and riding in the following vehicle in an automated mode. The questions were asked from the perspective of both – platoon leader and user sitting in the following car. Figure 17 and Figure 18 show the results regarding the required information by the platoon leader and by the platoon follower, i.e. the person sitting in the following car.

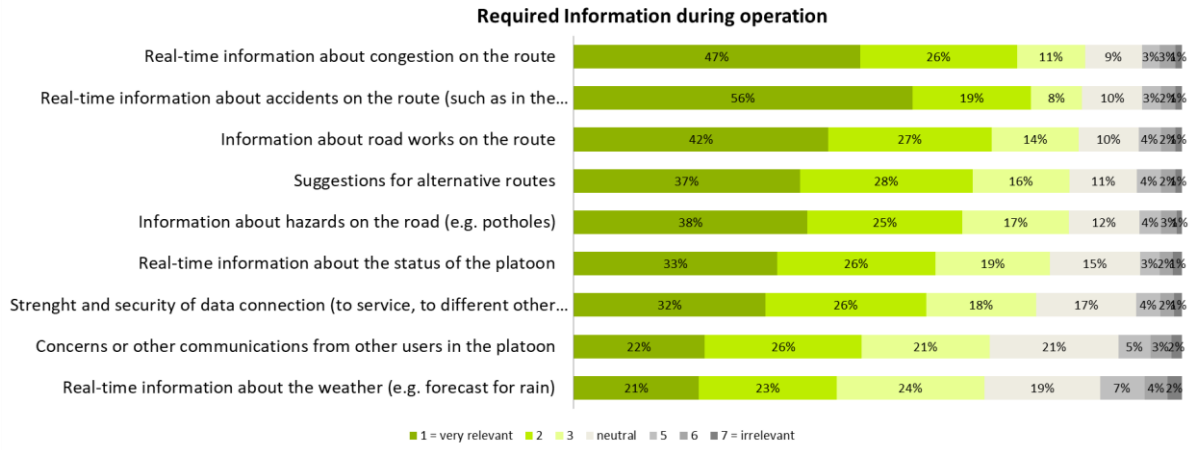



**Figure 17: Required information by the platoon leader during operation (N=1424)**

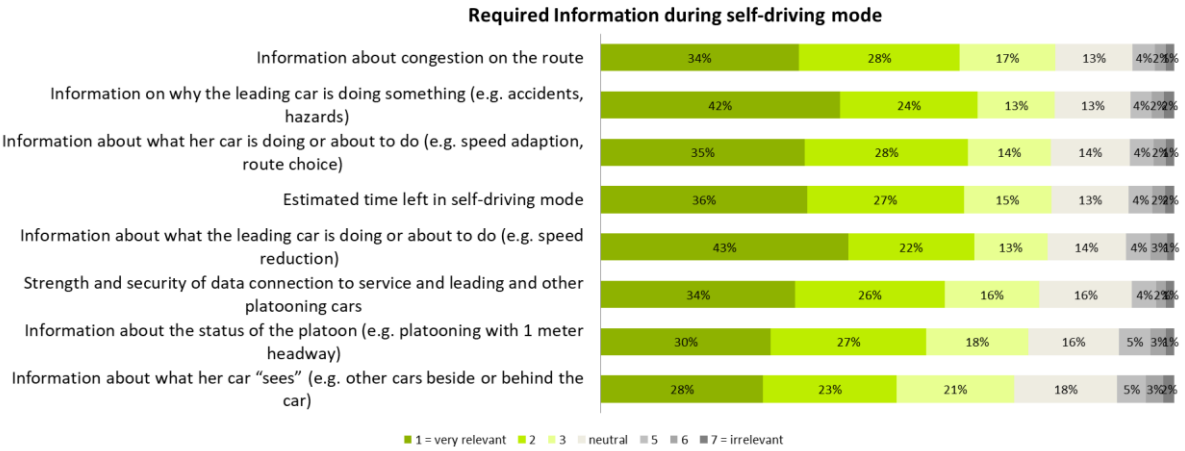



**Figure 18: Required information by the platoon follower during self-driving mode (N=1424)**

For the platoon leader especially real-time information about accidents and congestions are considered (very) relevant (75% and 73%) as well as information about road works (69%) and suggestions for alternative routes (65%). In comparison to the above aspects, information about concerns or other communications from other users in the platoon and real-time information about the weather are rated (very) relevant by fewer participants, although it is still relevant for almost half of them. As one of the following cars in self-driving mode the information rated (very) relevant by the most participants are, generally speaking, information about the driving behavior of the leading car, thus why the leading car is doing something (66%) and what the leading car is doing or about to do (e.g. reduction) (65%). Information about what the self-driving car is doing or about to do and the estimated time left in self-driving mode are rated equally relevant.

The country specific analysis showed again that respondents from the Netherlands have a tendency to rate the required information less relevant than most of the other countries, while Greece and Germany tend to evaluate the presented information more relevant. It is noteworthy that especially the rating of "very relevant" is chosen less frequently by participants from the Netherlands.

### 6.2.2 Concerns

#### 6.2.2.1 Concerns in advance of using the service

The presented concerns relate to the use of the service and take into account the perspective of the platoon leader and the cars in self-driving mode. General concerns during operation refer to cyber security (44% (very) concerned) and data privacy (40% (very) concerned) as well as the unknown platoon leader. 44% of the respondents are (very) concerned, that the leader might not be a safe driver and 40% are (very) concerned, that the leader might not be the person they say they are. One of the least concerns relate to the effect of the platooning app on the smartphone battery (25% (very) concerned).

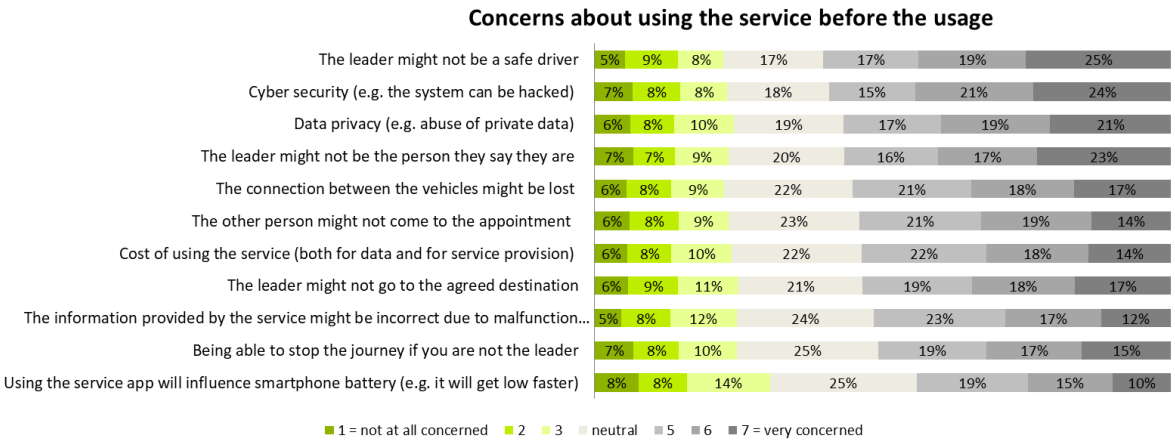



**Figure 19: Concerns about using the service before the actual usage (N=1424)**

### 6.2.2.2 Concerns about the service during operation

In the platoon leaders perspective (Figure 20) the responsibility for the safety of the following car(s) is most concerning (41% (very) concerned) followed by cyber security (40% (very) concerned) and technical failure of a following car (36% (very) concerned).

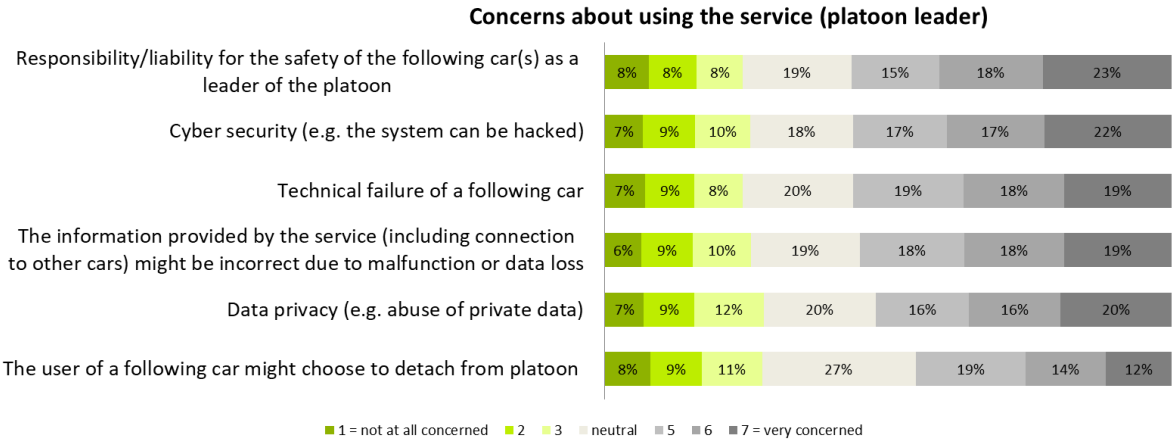



**Figure 20: Concerns about using the service from platoon leader perspective (N=1424)**

From the perspective of a potential user in a self-driving car that follows the platoon leader (Figure 21), 46% of the respondents claim to be (very) concerned about the safety of the self-driving mode, which is not necessarily an aspect that can only be attributed to the platooning use case, but probably refers to autonomous driving as such. Regarding the platooning service, participants are (very) concerned that the driver in the leading vehicle might have a bad driving style (44%). Cyber Security is for 41% of the respondents also a concerning aspect again.

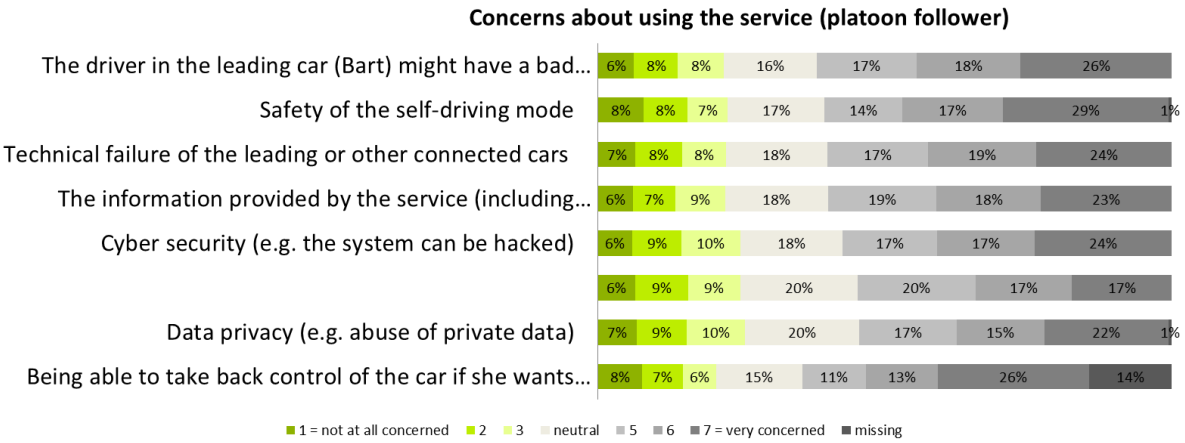



**Figure 21: Concerns about using the service from platoon follower perspective (N=1424)**

Country differences regarding the concerns are rather small and most participants seem to have the same level of concerns, but participants from Italy seem to be less concerned than other countries. For example, for cyber security just a quarter of the Italian respondents, but almost half of the British respondents claim to be (very) concerned.

### 6.2.3 Evaluation of the perceived experience

The overall assessment of the platooning scenario (Figure 22) was evaluated separately for the perspectives of the platoon leader and follower. The majority of the participants rated the scenario as a positive experience (77% from the follower's perspective scoring between 1 and 3 on a seven point scale ranging from a positive experience to negative experience and 78% from the platoon leader's perspective), whereas it was perceived as exciting, useful and easy to use for more than two thirds of the respondents. The biggest difference, though still rather small, between the two perspectives refers to the safety. 64% rated the scenario from the platoon leader's perspective as a safe experience in contrast to 60% from the follower's position.

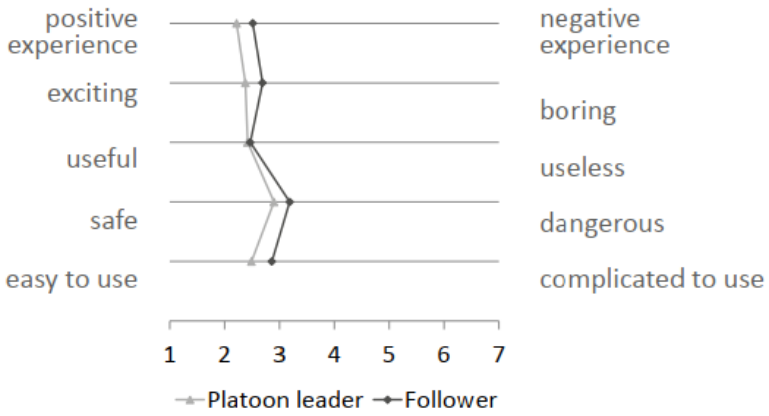



**Figure 22: Overall perceived experience from a platoon leader and from a follower perspective (N=1424)**

In general, the results indicate that the scenario is assessed slightly more positively from the perspective of the platoon leader. Even though most of the differences between both perspectives are statistically significant (e.g. for exciting vs. boring the score was lower, i.e. shifting more towards exciting, from the leader perspective ($M$ = 2,63, $SD$ = 1,42) than the follower perspective ($M$ = 2,69, $SD$ = 1,31), with $t$ = -2.25, $p$ = .025), the Cohens $d$ effect sizes reveal only very small, negligible effects (e.g. exciting vs. boring, $d$ = .055) with the biggest effect size for safe vs. dangerous ($d$ = .16), which still has to be judged as small according to Cohen's conventions (Cohen, 1988). The small effect size

can result, however, from a high variation within the full sample.

Thus, in the next step, clustering the sample around smaller groups (e.g. extremes coupled together) might provide additional insights on potential differences. Once again, the results suggest that the perception of safety might be a potential barrier to user acceptance of autonomous driving.

### 6.2.4 Willingness to use the service and preferences toward using the service over other travel modes

The next question asked how much respondents agreed with the statement "I would use the service for my trip if it was available".

Almost one third stated that they would use it instead of using a carsharing service or over driving a conventional car. A little bit higher share (ca. 35%) stated to imagine using it instead of using public transport. Note that about a third of the respondents chosen the option "neutral", suggesting high uncertainties regarding the potential use of the platooning service.

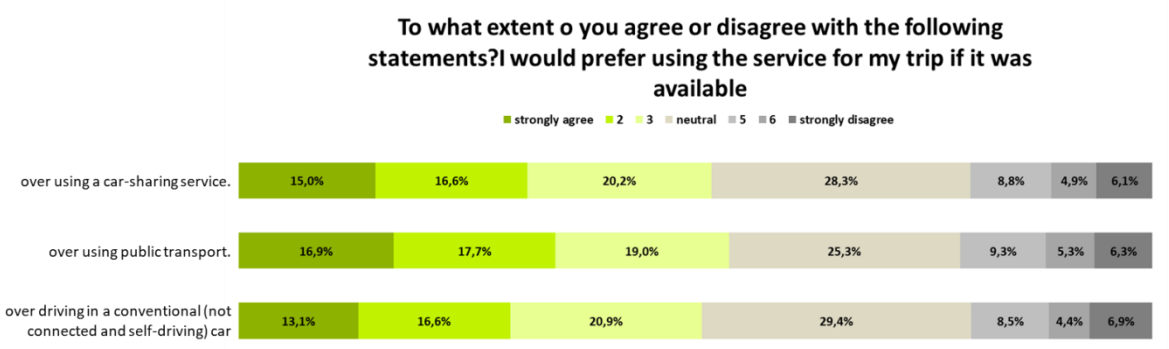



**Figure 23: Preferred situations/conditions of using a self-driving vehicle (n=1424)**

## 6.3 Scenario C: Main results

### 6.3.1 Requirements

#### 6.3.1.1 Information required during operation

In Scenario C, the relevance of the required information for the situations during operation and when picking up the parked vehicle was assessed.

The information rated (very) relevant during operation by most participants was the availability of a free parking spot (70%) followed by the location where the service is available on a city map (61%) as well as the (real-time) location of the car while it is parking and the free parking spot (58%) (Figure 24). Least relevant, though still relevant for more than half of the respondents, is the parking status of the car (e.g. it is parked now).

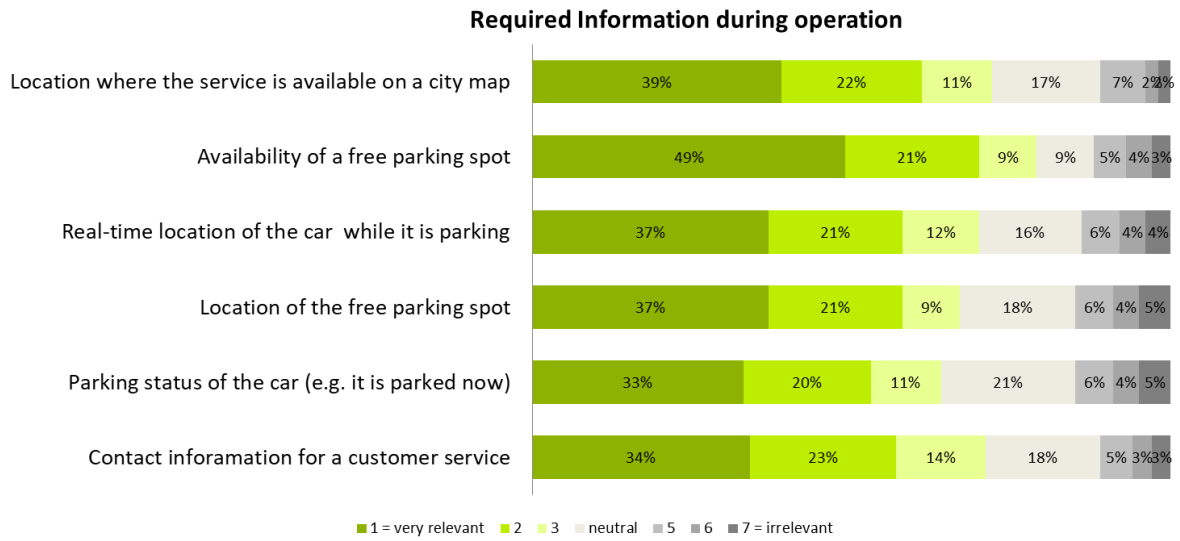



**Figure 24: Required information during operation of AVP (N=851)**

#### 6.3.1.2 Information required when picking up the vehicle

When picking up the parked vehicle the various presented information is judged as slightly less relevant than during operation (Figure 25). Most important is the information on real-time location of the car which is judged (very) relevant by 61% of the participants. Contact information for customer service is (very) relevant for half of the respondents while Information about what the car is doing or about to do (e.g. turning, braking) and what the car "sees" (e.g. detected pedestrians) is perceived as (very) relevant by less than half of the participants (42% and 44%).

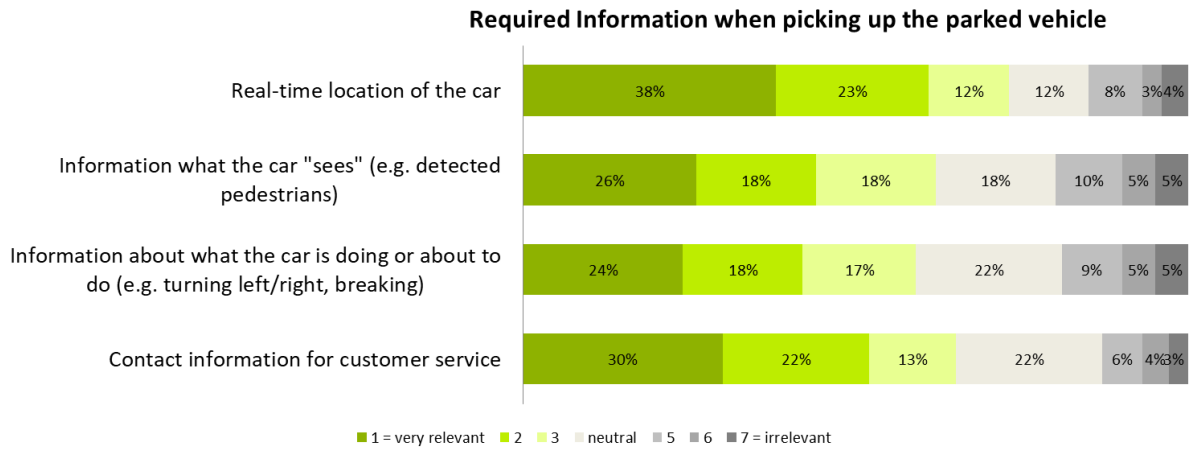



**Figure 25: Required information when picking up the vehicle in the AVP scenario (N=851)**

With regard to the country-specific analysis, the picture is the same as before in the other scenarios; participants from the Netherlands seem to rate the information as somewhat less relevant than respondents from the other countries.

### 6.3.2 Concerns

#### 6.3.2.1 Concerns when using the service

General concerns during operation refer to the reliability of the system, 43% are (very) concerned

that the automated system of the car might not work reliably, and relate to cyber security, 39% of the respondents claim to be (very) concerned, e.g. about vulnerability to hacking. Data privacy is a concern for a quarter (26%) of respondents.

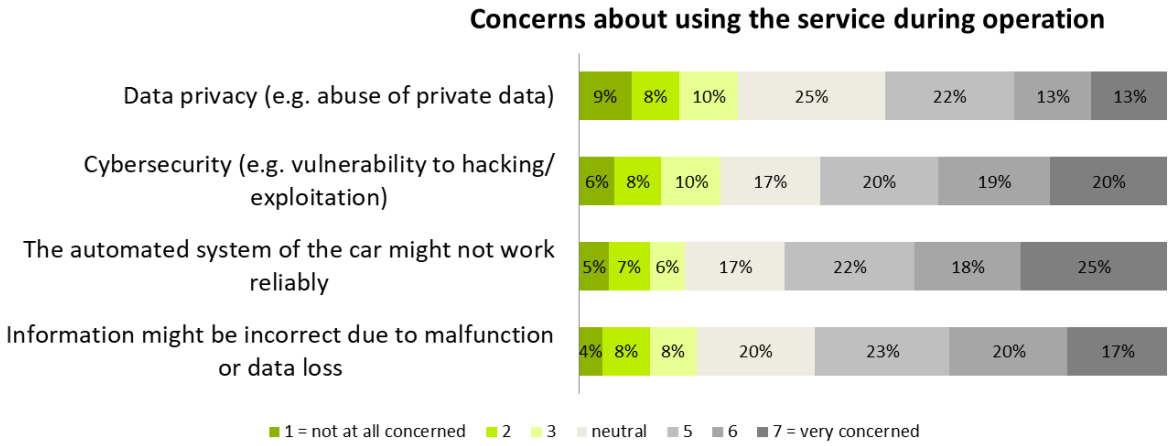



**Figure 26: Concerns when using the service of AVP (N=851)**

### 6.3.2.2 Concerns when picking up the vehicle

While waiting for the car to drive to the pick-up station the concerns are rather similar and include the reliability of the automated system (44% (very) concerned), cyber security (37% (very) concerned) as well as incorrect information due to malfunction or data loss (39% (very) concerned) and data privacy (26% (very) concerned). Thus, the main concerns regardless of the situation are related to both the reliability of the vehicle technology and cyber security.

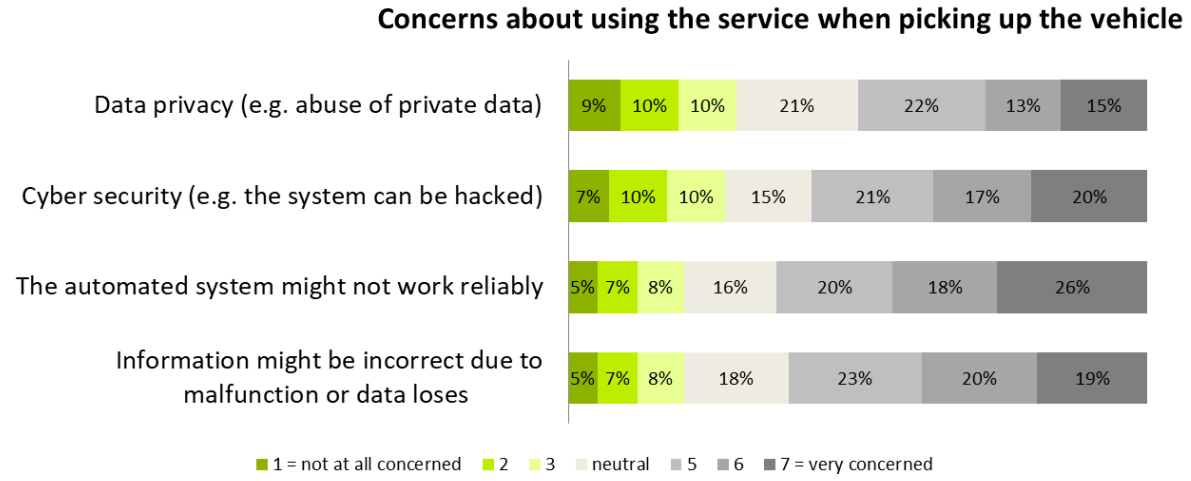



**Figure 27: Concerns when picking up the parked vehicle (N=851)**

Cyber security is for respondents from Italy and Greece less concerning than for the other respondents, but the reliability of the system concerns all respondents equally.

### 6.3.3 Evaluation of the perceived experience

The overall assessment of the automated valet parking scenario is positive. Over 70% evaluate the scenario as a positive experience (71% scoring between 1 and 3 on a seven point scale ranging from a

positive experience to negative experience), as exciting (75% scoring between 1 and 3 on the scale ranging from exciting to boring) and useful (76% scoring between 1 and 3 on the scale ranging from a useful to useless). Furthermore, 63% of the respondents perceived the scenario as easy to use. It is noteworthy that the safety aspect again receives the lowest approval, with only 44% of the participants rating this scenario as safe (scoring between 1 and 3 on the scale ranging from safe to dangerous).

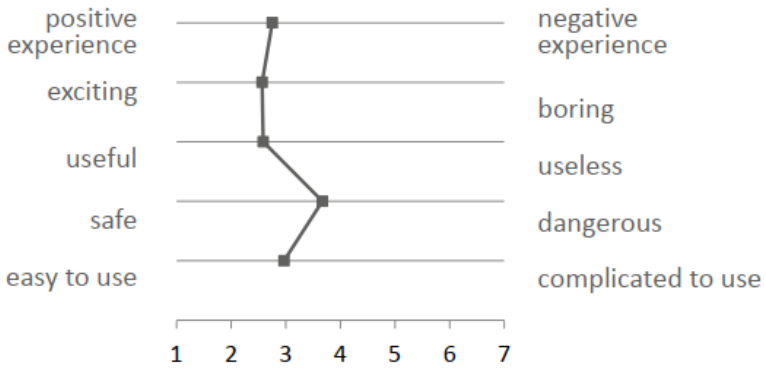



**Figure 28: Overall perceived experience for using AVP (N=851)**

### 6.3.4 Willingness to use the service and preferences toward using the service over other travel modes

In this survey again, respondents were asked how much they agreed with the statement "I would use the service for my trip if it was available". One third of the respondents agreed with this statement and stated that they would prefer the AVP over parking by themselves. Furthermore, again one third would use the service over using a conventional valet parking (another person is parking the car as a service.)

# 7 Discussion and conclusion

This deliverable presented the design and main results of an online survey, which was conducted in eight countries. The survey addressed requirements, expectations and concerns of potential users of a use case for enhancing automated driving with Internet of Things (IoT). The key findings that were determined from this survey are summarized below and based on these the recommendations of this deliverable are set out in the next section.

The service described in the three scenarios of the user survey is a new concept and not yet available. Both the concepts of automated driving and IoT are new terms and may seem abstract and difficult to relate to, as they are not visibly present in people's daily lives. The concept was explained to participants by using a short story and providing pictures.

In general, respondents across Europe were very positive towards the evaluated services and willing to try them. Regarding concerns, no options really stood out. This may be because the presented concepts are new and unique – concerns may rise at a later stage with use experience.

## 7.1 Scenario A: Carsharing as a touristic experience

### 7.1.1 Required information for the service

The results of the survey show that potential users are interested in receiving multiple types of information before using the service. For instance, route guidance to the pick-up station, information

about the vehicle-availability and instructions for using the service are highly desired by potential users. In addition to this, the respondents find it important to receive detailed information about the journey, such as estimated waiting times for a vehicle or the predicted route of the tour, as well as contact information for the customer service. During the operation of the service, the results of the survey show that great importance is accorded to real-time information about the touristic sights and the current vehicle location.

### 7.1.2 Concerns

The responses show that users have a significant level of concern in general. For each analysed concern, at least 40 % and a maximum of 51 % respondents were concerned (indicating 5 and above on a scale of 7). In this sense, 51 % of all respondents are concerned (5 and above) when it comes to the security of the payment process. This is also the concern with the highest amount of very concerned (indicating 7) respondents (19 %). The other concerns show similar levels of concern (5 and above), namely between 40 % and 45 %. Here, cyber security, data privacy and the impact of the service on the smartphone battery status, also show high level of concerns. In respect of other concerns raised by the respondents themselves, getting help in the case of technical failures or emergencies is mentioned the most.

The levels of concern that could eventually occur during the vehicle operation show little variation between the aspects. These are namely: malfunction or loss of data affecting the information, making pedestrians and cyclists feel uncomfortable and the probability of vehicle malfunction. They all show levels of concern (5 and above) at around 37% to 40%. Other mentioned and important concerns raised by the respondents are safety and the possibility of being able to stop to linger or when feeling ill. Of all other concerns that were mentioned, almost 50 % of these were scored as being very concerning.

The level of concern both before and during operation differed noticeably by country. Generally, respondents from the UK and Finland appeared most concerned whereas respondents from Italy and Greece appeared least concerned.

### 7.1.3 General evaluation

Results from the online survey for Scenario A (Sightseeing in Versailles), show that potential users value receiving versatile information. The experience was rated positive, exciting, useful, safe and easy to use. Most respondents would be willing to use it themselves. Many would also like to use the application for a sightseeing tour without a vehicle. Regarding concerns, about half of respondents expressed concern on the topics asked.

The service was rated useful especially for people with reduced mobility and single travellers or couples. The age groups, which would benefit most, were the middle aged and elder (ages 40–69). For payment, a fixed price for the tour was preferred over charging per used time or as part of a mobility and tourist package.

## 7.2 Scenario B: Platooning

Also for this scenario, the results of the survey suggest that potential users are interested in receiving multiple types of information before using the service. The Platooning scenario is more complicated than the touristic experience scenario as it requires survey participants to consider the services from two perspectives – from the perspective of the platoon leader and from the perspective of the person sitting in the following car in the platoon who can potentially drive autonomously if he/ she want to.

### 7.2.1 Required information for the service

In total, the results show that information during platooning have a high relevance to potential users. In particular information on the driving behavior of the leading vehicle and the following cars in self-driving mode as well as events that might influence this behavior are highly relevant to the respondents. Information when considering the service is overall rated relevant by fewer people, but here as well information concerning the trip itself is the most relevant.

### 7.2.2 Concerns

The main concerns in the Platooning-Scenario are related to both the reliability of the system, including cyber security and the self-driving mode, as well as the driving behavior and identity of the platoon leader. In general, at least a quarter of the participants evaluate any aspect as alarming, showing that there are a lot of concerns that need to be addressed in the future.

### 7.2.3 General evaluation

In general, the results of the study of the Scenario B (Platooning) indicate that the use case is assessed slightly more positively from the perspective of the platoon leader than from the perspective of the follower. Possible reasons behind that could be higher concern regarding the automated driving mode, which are only relevant for the platoon follower, and the leader being more in control over the driving situation as having control options is required by the most of the study participants.

## 7.3 Scenario C: Automated Valet Parking

### 7.3.1 Required information for the service

In the case of AVP, potential users require real-time information that supports the use of the service, but also monitoring options. The results show overall interest in the service, but also that the potential users would still like to have the control over the parking situation and to intervene when needed. Potentially, the requirements can be only in the early stage of the usage when people do not trust the technology and want to ensure being in control over the situation. As this type of information is available to the user because of the IoT connectivity part of the service, the results suggest that IoT might play an important role in the early stage of the introduction of the technology in the market by ensuring trust in the technology.

### 7.3.2 Concerns

Main concerns are overall related to cyber security and the reliability of the vehicle technology. Once again, these results confirm the important role of control options in form of provision of relevant information to the user in order to ensure trusting the service. Also, these results indicate high importance of ensuring secure connection of IoT based services.

### 7.3.3 General evaluation

The service was evaluated overall positively by potential users. However, this use case was also the one which score lowest at the aspect “safe” confirming the concerns of potential users regarding potential malfunctions of the vehicle during operation.

## 7.4 Overall conclusions

Based on the results of the study, some general recommendations for developing the services were derived. The results suggest that making the service easy to use and customizable plays an important

role in ensuring user acceptance (i.e. willingness to use the service). In particular, coping with concerns related to the safety during the execution of the self-driving functions by providing sufficient information about what the vehicle is doing or about to do for instance, would be crucial. In all these aspects, the IoT will play a crucial role in enabling the provision of more detailed information in real time. Concerns related to payment security and malfunctions are important for both developers and service providers and users, as they can potentially affect users' trust in IoT systems' use during automated driving.

Therefore, we concluded the following benefits of IoT for AD when considering user acceptance: first, IoT can enable using the services with AD through easier trip planning by providing real-time traffic system information. This aspect is related to the performance of the system. Second, IoT can accelerate the market deployment of AD services as trust in the system is increased by providing information about the vehicle operation – one aspect which is crucial for user acceptance of AD. This point can be considered as a base IoT-function for AD mainly because it increases the sense of control when driving automatically. Third, IoT can contribute enhancing the user experience by providing real-time information about POIs and enabling customization options. This aspect is rather an excitement than a performance factor which can be also crucial when considering using an AD-based service.

All in one, all aspects – making the service useful from user perspective, its performance understandable and reliable as well as enhancing the experience - have to be considered when developing new services. The weight, i.e., the importance, of the different factors on the decision for using the service, can be further explored in future research. Moreover, user tests allowing potential users to experience the service, as planned within the "AUTOPILOT" project, can additionally provide important insights on developing key features of the service and suitable human-machine-interaction.

# 8 Recommendations for Pilot Testing

## 8.1 Recommendations for use-case pilot testing design

Based on the results of the survey, the following recommendations for use-case pilot testing design can be derived:

- Information for planning and using the service must be clear and accessible to ensure ease of use and confidence in the service. This includes tourist information, vehicle operation (to ensure trust) and service costs.
- As half of participants show concern regarding the security of the payment process, great emphasis should be placed on that (e.g. using well-established payment methods or providers).
- It is important to provide the users with substantial help in the case of technical failures or emergencies.
- The service should be made easy to use and customisable, allowing for
    - different user groups,
    - choosing between manual and automated driving,
    - choosing when to stop the vehicle,
    - lowering speed,
    - multiple payment options, and
    - choosing which information is provided.
- It is important to ensure the user gets enough information on the service and how it works.
- Wherever possible, the service should be easily transferable to other locations.

## 8.2 Recommendations on the user acceptance evaluation on the test sites

Further recommendations address requirements for the user acceptance evaluation on the test sites:

- Real tourists would prove a valuable sample not only for the validity of the findings but because the results about the preferences of use were different in the French sample compared to the rest of the countries. Familiarization and previous experience might have played an important role in their responses – 56% of the respondents in France stated that they have visited Versailles compared to less than 30% in all other countries
- Background information about the participants regarding the type of traveler and/or tourist they are might be useful as their existing preferences and attitudes might affect the results.
- Participants prefer to register (and be contacted) with their email addresses more than any other method and this was a consistent finding across countries.
- Some of the main concerns of the respondents were related to the safety of the vehicle. Thus, one important topic at the pilot tests should be discussing different solutions how to ensure trust, i.e., increase the perceived safety level, when riding in a self-driving car. A special focus here, considering the aim of the project, should lie on information providing using the IoT features.
- It is important in the focus groups to ensure that steering questions are open enough for respondents to raise other concerns than those specifically raised, as in the online survey this identified some wide spread high concerns such as the general concept of automation, allowing autonomy to the user and service costs.

# 9 References

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# 10 Annexes

## 10.1 Scenario A: Results per country

### 10.1.1 Information required before using the service

10.1.1.1 Route guidance to the pick-up station

As indicated above, the route guidance to the pick-up station is evaluated as one of the most relevant pieces of information when booking the service. In Greece and from the UK, there was the highest share of respondents (over 60 % compared to 34 to 50% in other countries) that evaluated this type of information as *“very relevant”*. Overall, the differences between the countries are rather small.

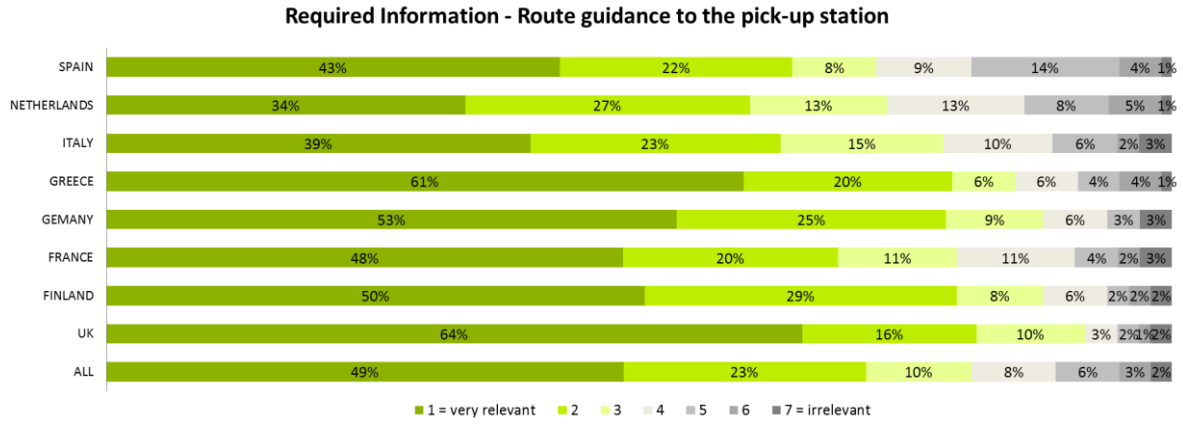



**Figure 29: Required information – route guidance to the pick-up station**

10.1.1.2 Availability of a vehicle

Information about the availability of a vehicle was considered *“very relevant”* by more than half of the whole sample (53%). Interestingly, in Germany almost 70 % evaluated this information as *“very*

*relevant",* and in the UK, Greece and Finland almost or over 60 %. This might indicate that tourists coming from these countries tend to be more interested to have information supporting them to better plan the usage of the service.

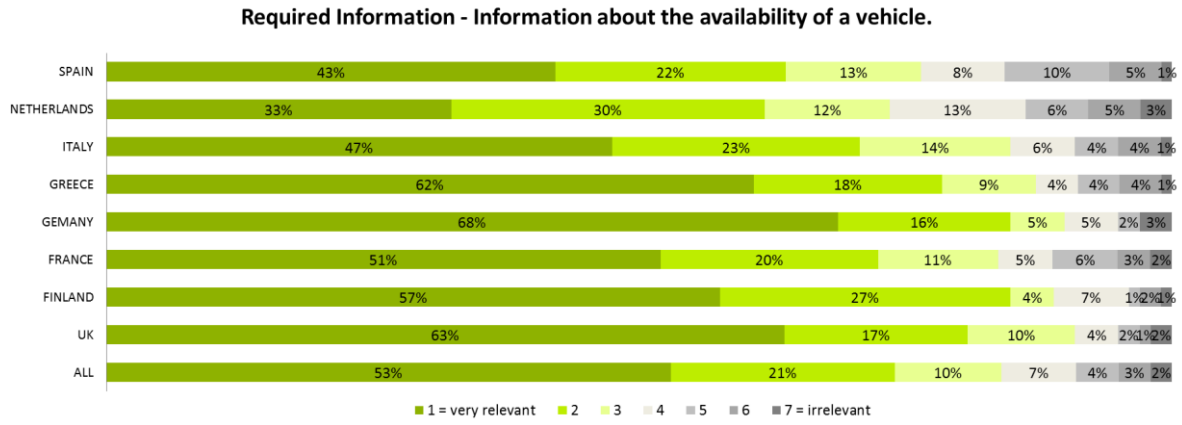



**Figure 30: Required information – availability of a vehicle**

#### 10.1.1.3 Estimated waiting time in case that no vehicle is available

Considering the relevance of an estimated waiting time in the case that no vehicle is currently available, a similar tendency as in the preferences toward the information about availability of a vehicle can be found in some of the countries. The smallest share of respondents who evaluated this type of information as relevant is in the Netherlands and France.

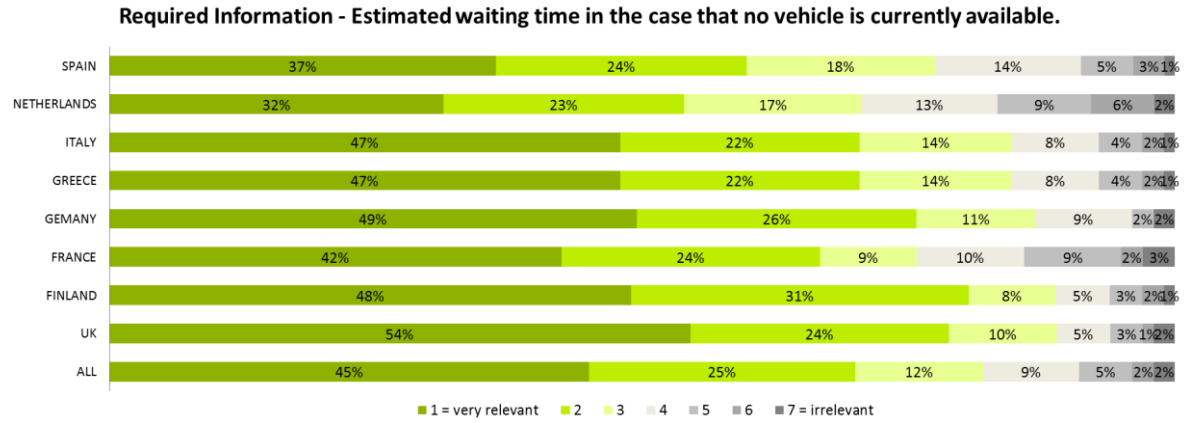



**Figure 31: Required information – estimated waiting time when no vehicle is available**

#### 10.1.1.4 The route of the tour

In the Information about the route of the tour is evaluated as *"very relevant"* mainly by respondents from Greece and the UK (more than half of respondents), followed by Spain, France and Finland. Here again, the respondents from the Netherlands tend to evaluate the level of relevance in a less extreme way (i.e., the information as less extremely relevant) than in the other countries.

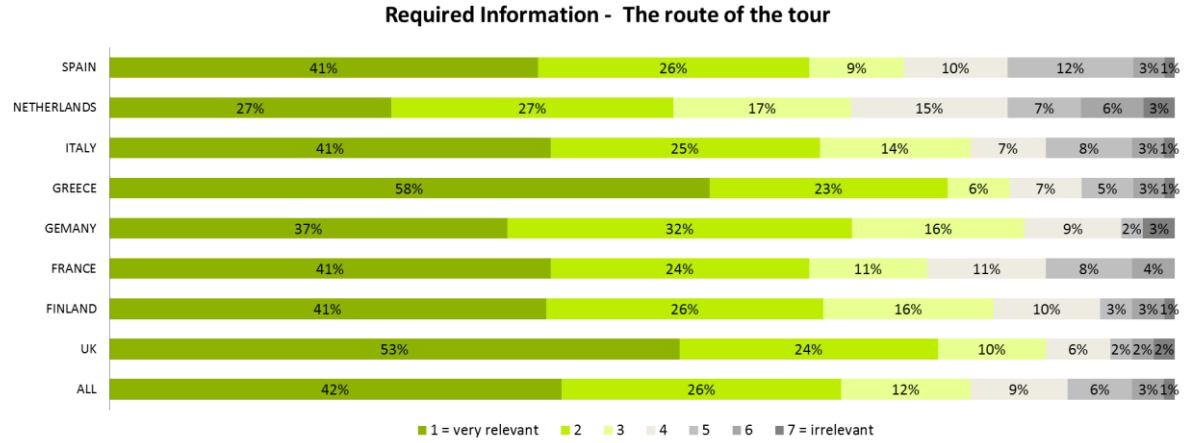



**Figure 32: Required information – route of the tour**

### 10.1.1.5 Congestion on the planned route

Providing information about congestion on the planned route was rather less relevant for the respondents than other types of information. The comparison between the countries shows that in Greece and UK, this type of information is evaluated as more relevant than in the other countries.

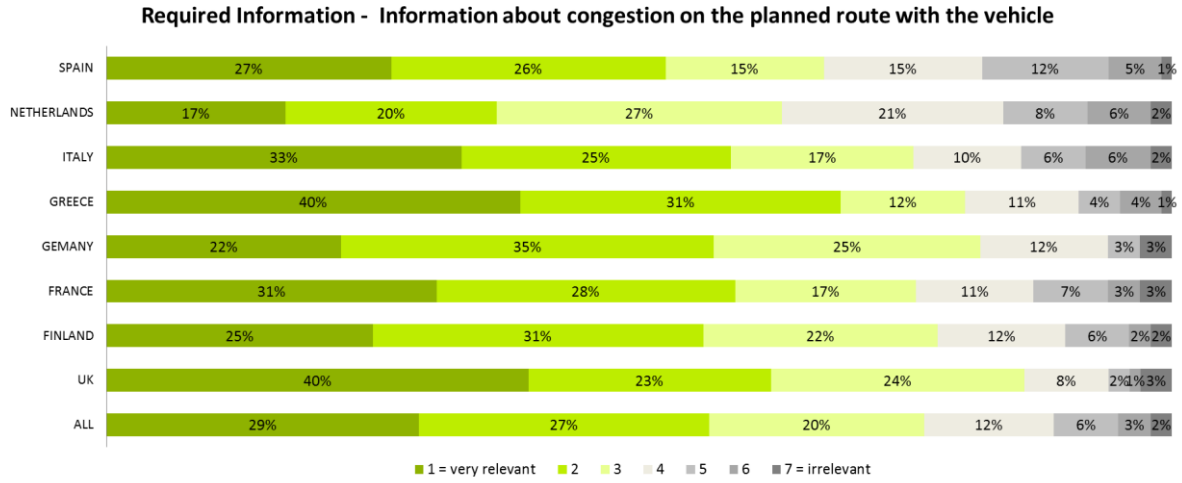



**Figure 33: Required information – congestion on the route**

### 10.1.1.6 (Personal) data required for using the service

Furthermore, the information about which (personal) data is required for using the service was evaluated as slightly less relevant as the other types of information provided by the service. However, in Italy, Greece, Germany, Finland and UK, the relevance of this type of information was higher than in the other countries.

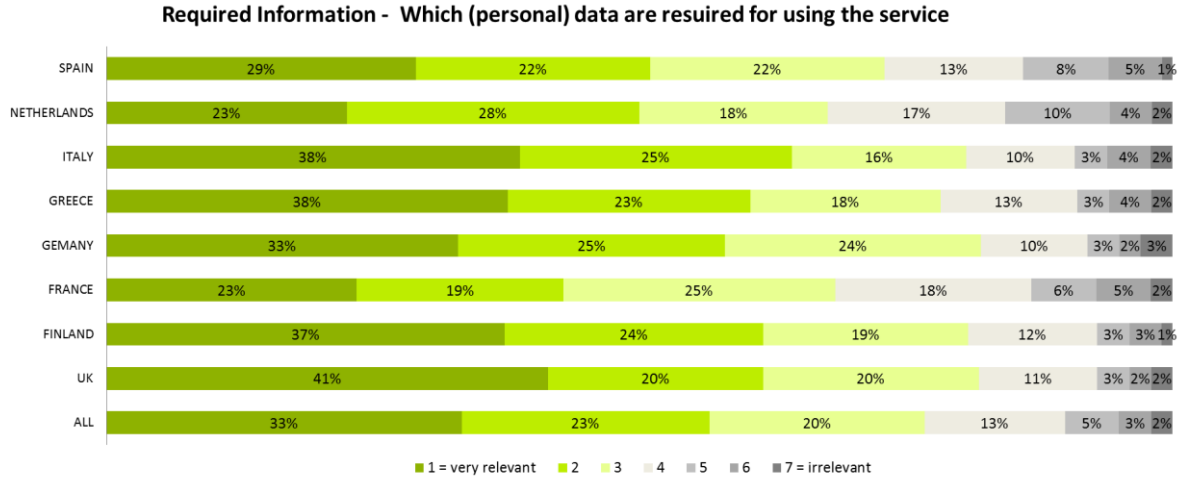



**Figure 34: Required information – personal data required**

### 10.1.1.7 Instruction for how to use the service

Information providing instructions on how to use the service is among the types of information that were evaluated as most relevant by the respondents. Comparing the different countries shows that the relevance of this information is slightly higher in the UK and in Finland than in the other countries – most of the respondents in these two countries (60 to 67% of the samples) evaluate the information as *"very relevant".*

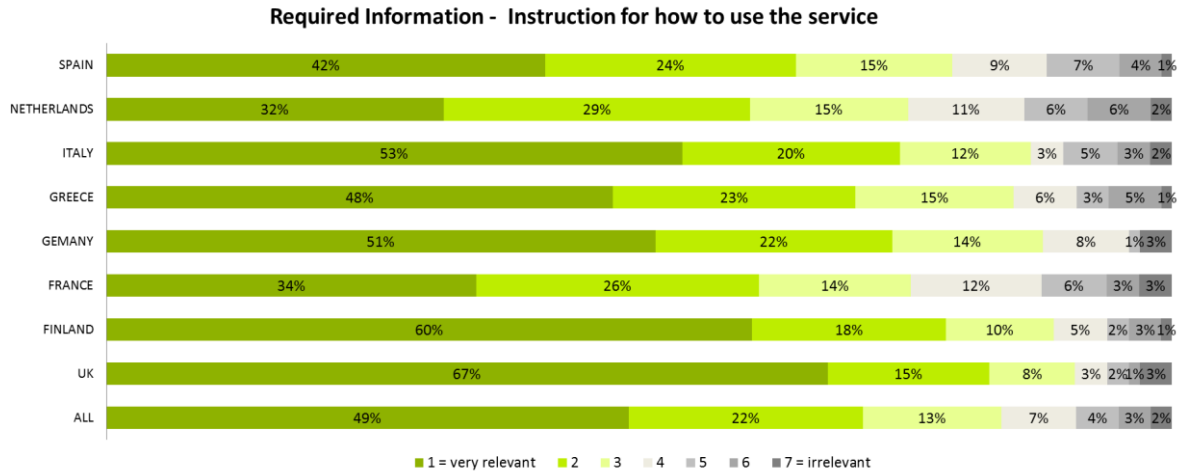



**Figure 35: Required information – instruction how to use the service**

### 10.1.1.8 Availability of a free spot at the return stations

Information about the availability of a free parking lot at the return station seems to be more relevant in the UK and Finland compared to the other evaluated countries, followed by Italy and Greece. In general, the differences between the rest of the countries are rather small, with the exception of the Netherlands, where the relevance of this type of information is evaluated as *"very relevant"* by one third of the respondents only. However, here again, still about 75% of the respondents evaluate this type of information as relevant (values between 1 and 3). General differences in the responses of persons from the Netherlands and from the other countries might be related to differences in the mobility behavior in the different countries. For instance, in the Netherlands is the highest share of people which use rather a bicycle than a car as a main mode of transportation in their everyday mobility (see Annex, part "Mobility behavior").

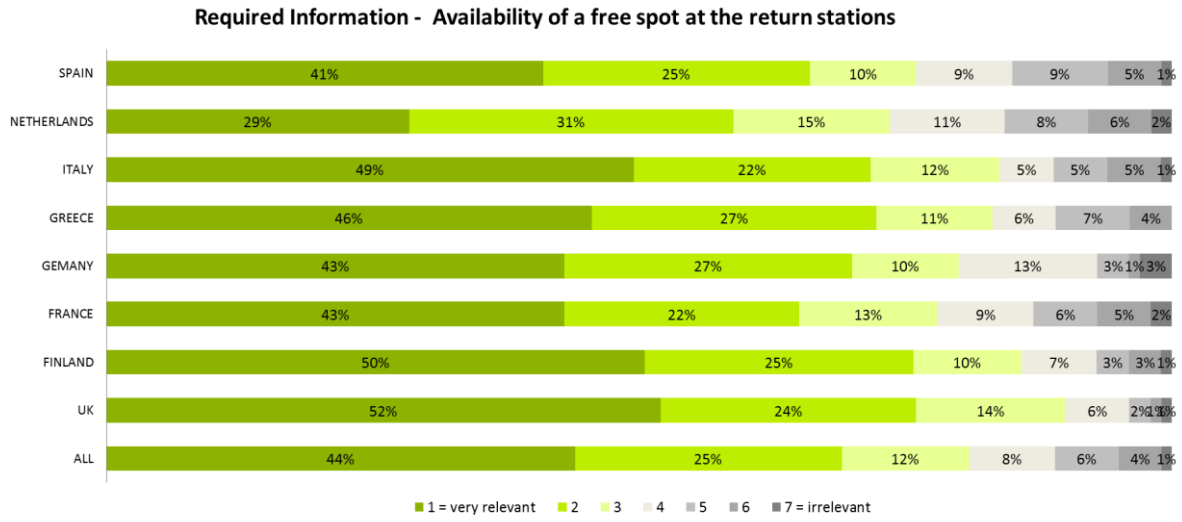



**Figure 36: Required information – availability of a return spot**

#### 10.1.1.9 Contact information for a customer service

Providing contact information for the customer service is evaluated as more relevant in Finland, UK, Germany and Greece compared to the other countries. At the same time, in Spain and the Netherlands this type of information is rated as slightly less relevant compared to the other countries.

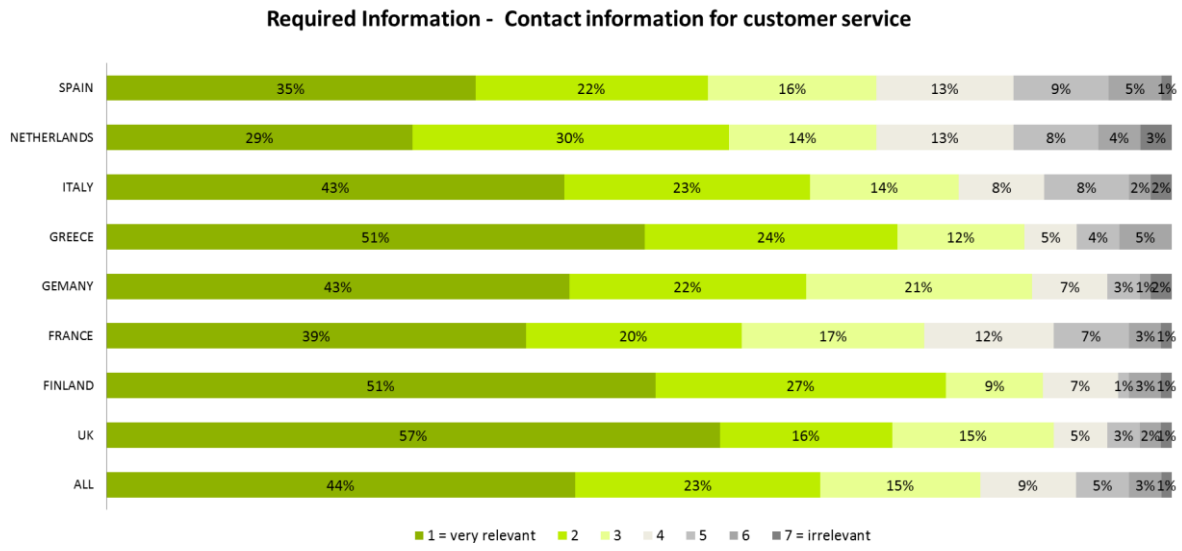



**Figure 37: Required information – contact data for customer service**

#### 10.1.1.10 Tourist information

Providing tourist information at the beginning of the trip, i.e. when booking the service seems to be less relevant as the other types of information. However, especially in Greece and in the UK, tourist information seems to have higher relevance than in the other countries, followed by Italy and Finland. However, also here, the differences between the countries are rather small.

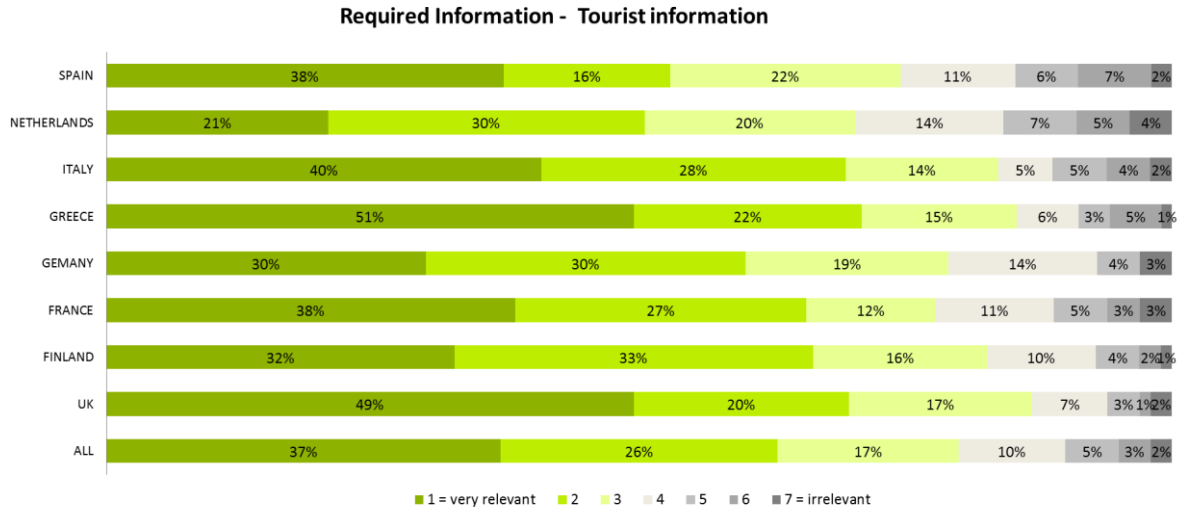



**Figure 38: Tourist information – in advance**

10.1.1.11 Information about restaurants, cafés, etc.

Overall, information about restaurants, hotels, cafés, etc. has the lowest values for relevance from all types of information that can be provided to the service users, but it is still considered relevant. Only in UK and Greece, many of the respondents (about 40%) evaluated this information as *"very relevant"*.

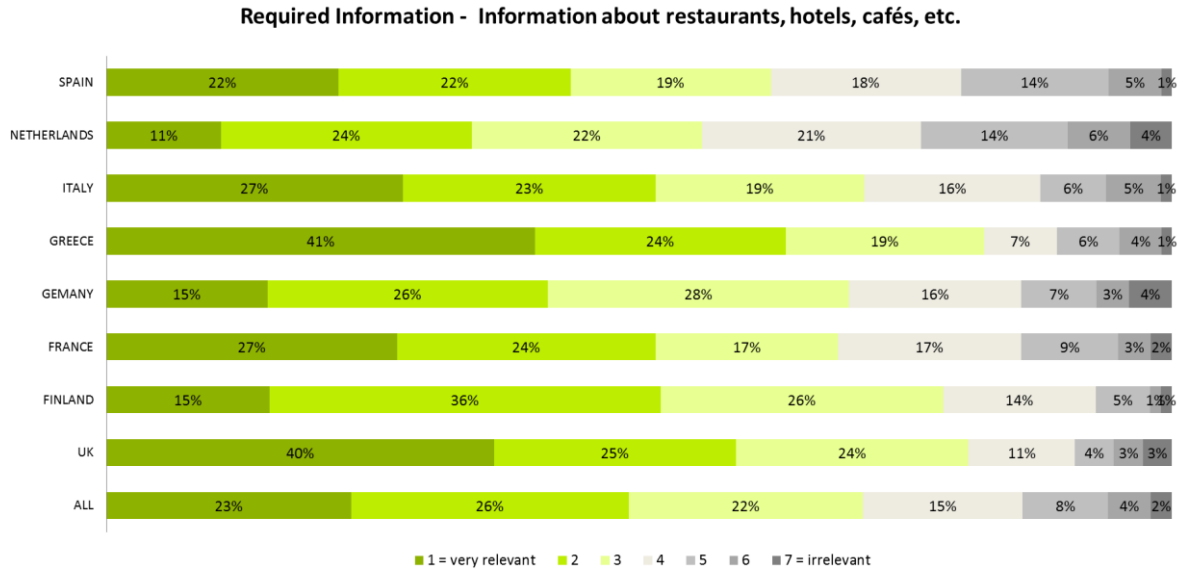



**Figure 39: Required information – information about restaurants, café´s, etc.**

## 10.1.2 Information required during operation

10.1.2.1 Real-time location of the vehicle

The evaluation of the relevance of information about the real-time location of the vehicle during the trip by the respondents from the Netherlands shows very heterogeneous picture – 60% of the respondents evaluate the relevance with values between 1 and 3 (on the 7-point scale) which is a smaller share of the sample compared to the other countries. In all other countries, this type of information is evaluated as (very) relevant with rather small differences between the countries.

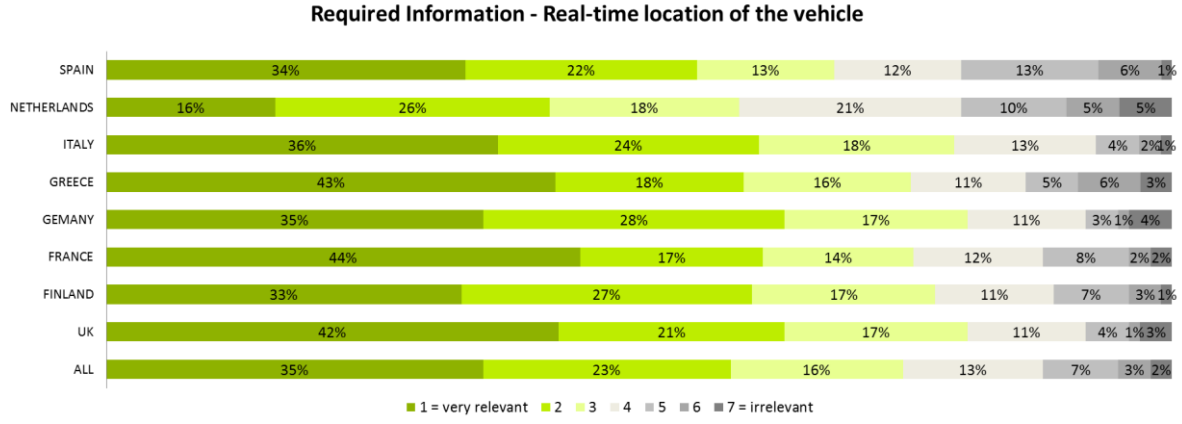



**Figure 40: Required information – real-time location of the vehicle**

10.1.2.2 Contact information for a customer service

The contact information for a customer service seems to be less relevant during the operation than when booking the service. However, this might also indicate that respondents assume to receive this

type of information at the beginning of the usage and hence, to have it available also during the usage. In Greece, UK, Finland and Italy, this information is evaluated as slightly more relevant than in the other countries.

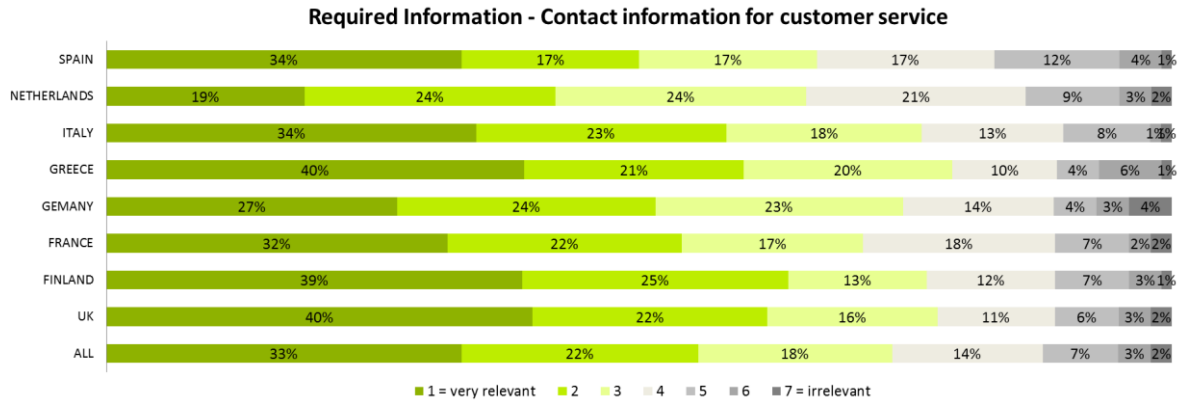



**Figure 41: Required information – contact information for a customer service**

The tendencies in the answers are similar to the answers for the same question above. This indicates that even if the relevance of this type of information seems to be lower than when booking the vehicle, the differences between the countries remain the same.

### 10.1.2.3 Information about the vehicle operation

The information about what the vehicle “sees” is part of the information provided by the service to give a feedback about the vehicle operation and status of the self-driving mode to the passenger. The relevance of this type of information is the highest in the following countries: the UK, Italy and Greece, followed by France and Spain, whereas in the Netherlands, only slightly over half (58 %) consider it relevant.

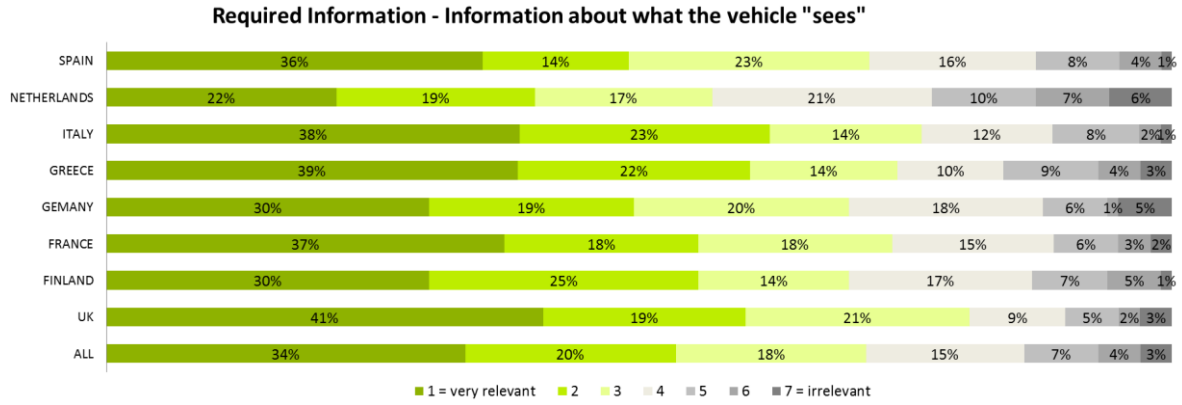



**Figure 42: Required information - vehicles´perception**

The requirements on the information about what the vehicle is doing or about to do seem to be slightly more relevant than the information about what the vehicle “sees”. The relevance of this type of information is rated highest in Italy.

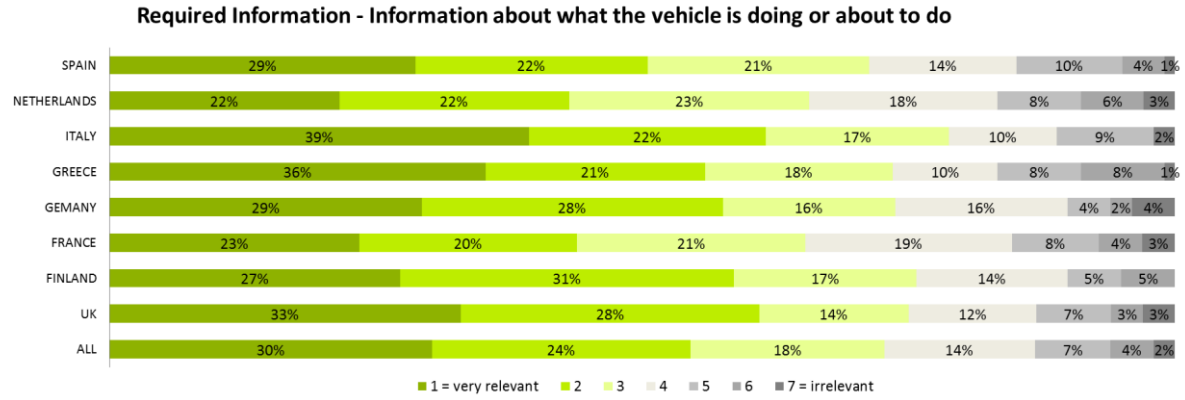



**Figure 43: Required information – vehicle operation**

### 10.1.2.4 Real-time tourist information

Real-time tourist information, including points of interest or sights near the location of the user, has slightly higher relevance for the respondents than the information about the vehicle operation. In Italy, Greece and the UK, the relevance of this type of information is rated higher than in the other countries.

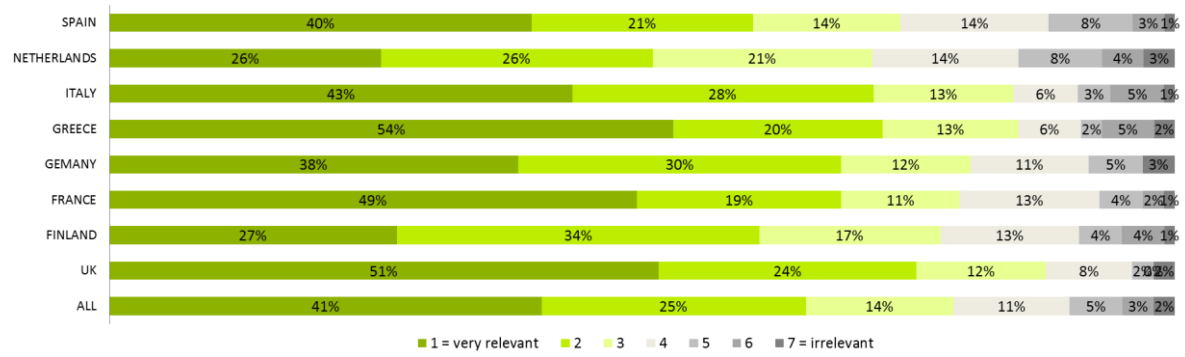



**Figure 44: Required information – real-time tourist information**

Comparing these results with the answers on the same question when booking the service shows that the relevance of this type of information is, as expected, slightly higher during operation, meaning using the service driving in self-driving mode in the Gardens of Versailles, than when booking the service and reserving a vehicle.

Further analyses of the perceived relevance of different types of information depending on age, gender and other individual characteristics will follow in the further works in the user acceptance task.

### 10.1.3 **Concerns**

#### 10.1.3.1 Data Privacy

Overall, data privacy is a strong concern for 40% of the respondents, and a very strong concern for 13% of the respondents. The UK had the highest proportion of respondents being very concerned, which double the amount of other countries' concerns. However, Spain had the next highest proportion of respondents being very concerned, with a very low proportion that were not concerned at all and was the only country where more than 50% of respondents scored their level of concern highly. Across the countries, Italian and Greek respondents appear to be the least concerned, having the highest proportions of not being concerned at all about data privacy, and were also the highest proportions having little or no concern.

#### 10.1.3.2 Cyber Security

Cyber security is the 2nd most concerning specific aspect across all countries, with the proportion of respondents being very concerned varying between 5 and 22% between countries. Similarly to other aspects, the UK had the highest proportion of respondents that were very concerned about cyber security. Spain and Finland also have high proportions, and Finland also has the lowest proportion of respondents who are not concerned across all countries. Italy is the country with the highest share having little or no concern, and the lowest share who are highly and very concerned, suggesting it is the least concerned country.

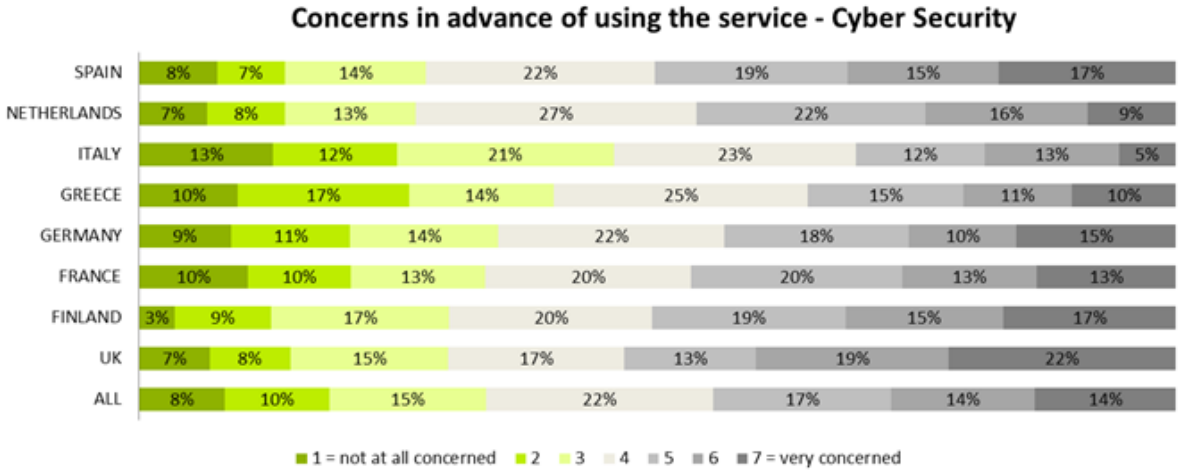



**Figure 45 Concerns – cyber security**

### 10.1.3.3 Smartphone Battery

Although there are high levels of concern across all countries, as with other aspects Spain and Italy have the least concern about the service affecting smartphone battery, with the highest shares of respondents registering no or little concern, as well as the smallest shares registering as highly or very concerned. The UK would seem to be the most concerned country with both the smallest proportion with little or no concern, and the highest portion being very concerned with over 50% of respondents registering high levels of concern.

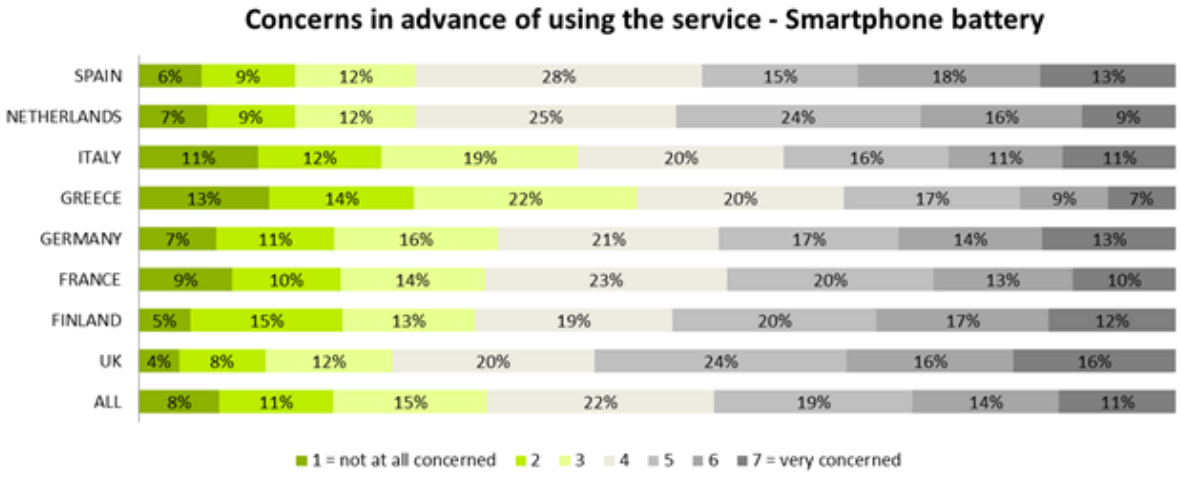



**Figure 46: Concerns – smartphone battery**

### 10.1.3.4 Data Loss or Malfunction affecting information

This is the specific aspect which appears to be least concerning across all countries, with the highest levels of little or no concern, and lowest share of highly concerned with only 10% being very concerned. Greece has the highest shares of both no or little concerns, as well as the lowest share being highly concerned. Spain, Finland and UK all have low shares with no or little concern, and the highest shares of those being highly or very concerned.

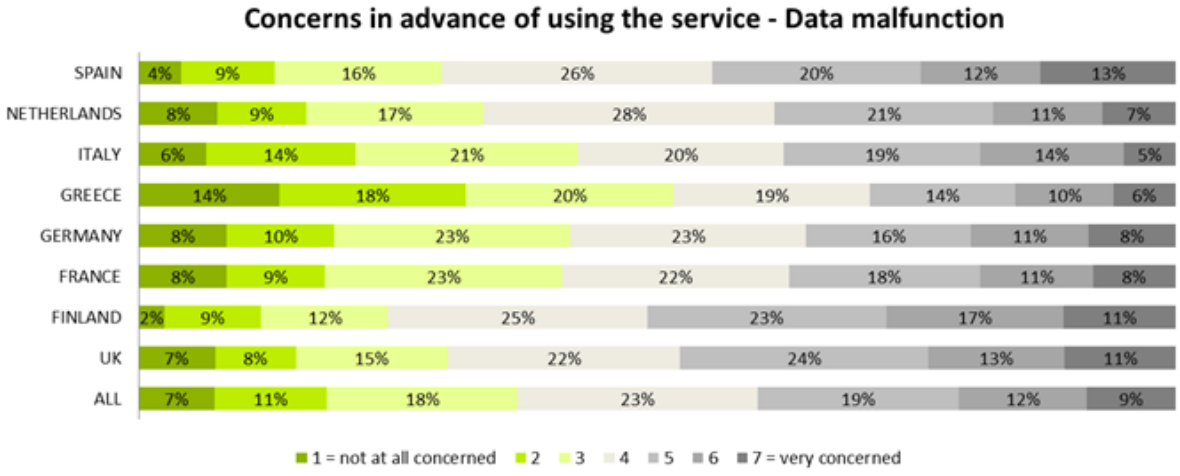



**Figure 47: Concerns – data malfunction**

### 10.1.3.5 Payment Process

Payment processing is the specific aspect that is most concerning across all countries, with 50% of people highly concerned and 19% very concerned. Almost a third of the UK respondents are very concerned about the payment process for the service, and France, Finland and Spain, also have high proportions who are very concerned and around 60% of respondents are highly concerned. Greece and Italy are once again the least concerned.

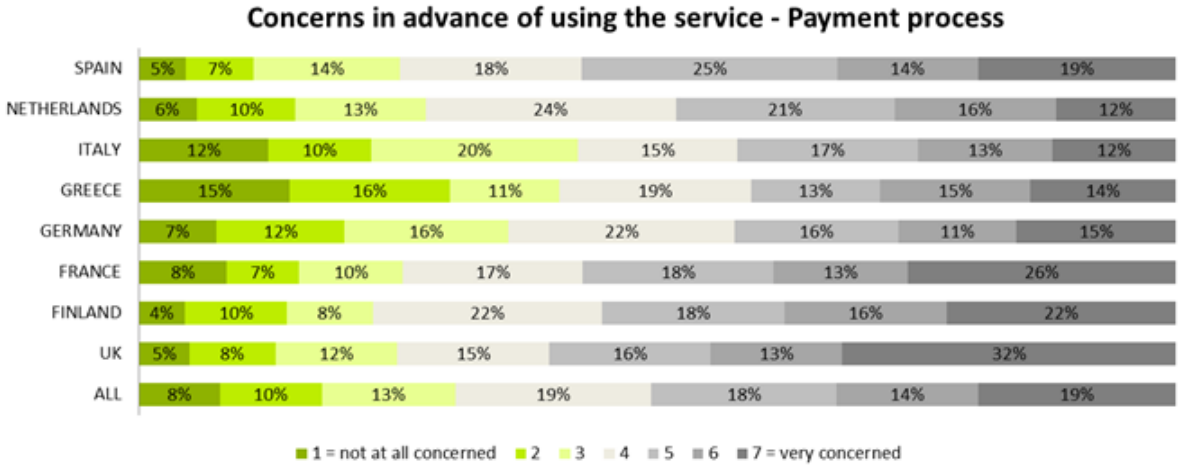



**Figure 48: Concerns – payment process**

### 10.1.3.6 Other Concerns

Respondents were asked if they had any other concerns in advance of using the service. For all countries, less than 10% of respondents offered any other concerns. There were much more extreme views regarding other concerns than the specific aspects. Nearly a third of these respondents were very concerned but also almost 20% were not at all concerned, around double that of any of the specific aspects. The concerns varied but were grouped into broad categories, which are presented in Table 3. Some of the stated concerns were the same as the specific aspects already rated, so it may be that the respondents did not fully understand the question. The largest concern was related to how one would get help when there is a technical failure or emergency in the service (which is related to Question 5 were information was scored as highly relevant), and there were also many concerns related to data and safety.

**Table 3 - Other Concerns**

| Concern | Number of Respondents |
|---|---|
| **Getting help in technical failure/emergency** | 16 |
| **Data cost, connection and use** | 13 |
| **Safety** | 11 |
| **Break-down, malfunction, reliability, performance** | 7 |
| **Insurance / deposit** | 7 |
| **Data protection** | 6 |
| **Mobile running out of charge / no smartphone** | 6 |
| **The general concept of automated driving** | 5 |
| **Service fee** | 5 |
| **App malfunction** | 5 |
| **Payment system** | 4 |
| **State of charge on receipt of vehicle** | 4 |
| **Personal security** | 3 |
| **Availability** | 3 |
| **Wrong route / knowing exact location** | 3 |

| | |
|---|---|
| **Duration of service** | 2 |
| **Ease** | 2 |
| **comfort and cleanliness of vehicles** | 2 |
| **Weather** | 1 |
| **Distraction of app from sights** | 1 |

10.1.3.7 Concerns about using the service during operation

A follow up question to the above asked the respondents to then place themselves in the position of a user and relate what their concerns were. This was more limited than the first question, and focused only on vehicle malfunction, making other pedestrians and cyclists feel uncomfortable and data loss/malfunction affecting information. Similar to the concerns prior to using the service, there is little variation in levels of concern between the three aspects that are proposed, and there is a relatively even spread, with the greatest concerns appearing to be related to the probability of vehicle malfunction and the least concerning aspect being malfunction or loss of data.

Again, less than 10% of respondents registered any other concerns, but almost 50% of these concerns were scored as being very concerning. The main concern was safety of the vehicle, but there were also many concerns about being able to stop the vehicle during the tour if they wanted to linger at a spot, or if they felt ill.

Trends between countries reflected those about concerns prior to operation - Greece and Italy being the least concerned and UK, Finland and Spain being the most concerned.

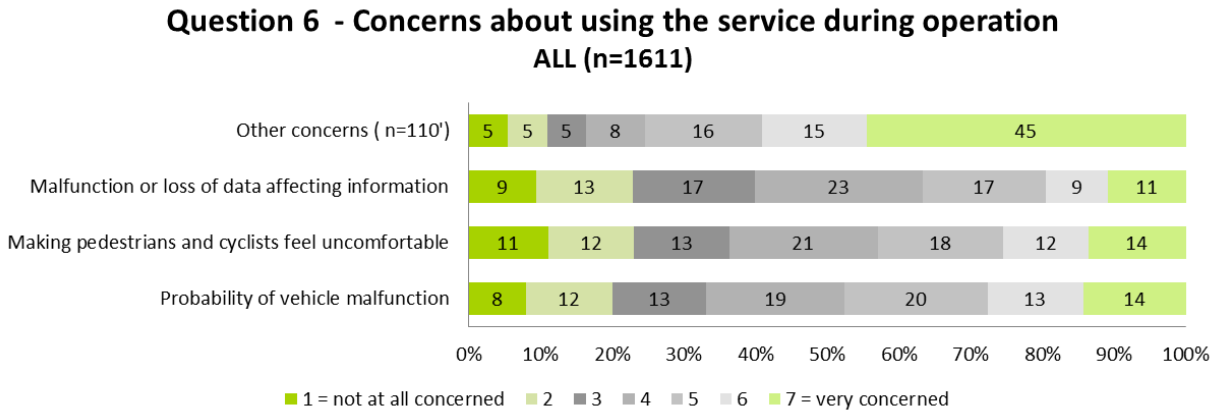



**Figure 49: Concerns about use during operation**

### 10.1.3.8 Probability of Vehicle Malfunction

There are high levels of concern about vehicle malfunction across all countries, with only two countries having less than 10% of respondents being very concerned, and all having over 40% being highly concerned. Similar to many aspects before operations, Greece and Italy have the lowest levels of concern, the UK has the highest share being very concerned, and Finland has the lowest share having no concerns.

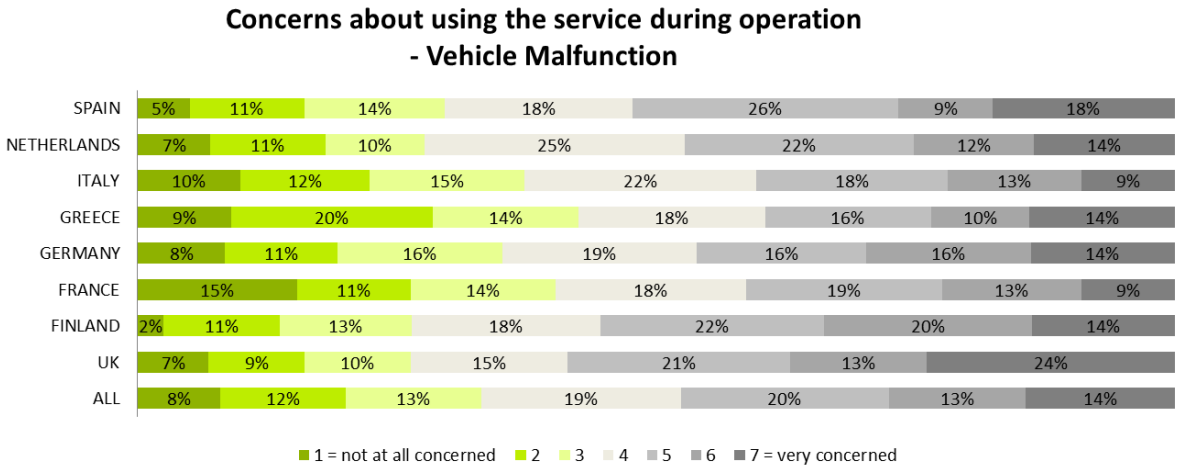



**Figure 50: Concerns - vehicle malfunction by country**

### 10.1.3.9 Making Pedestrians and Cyclists feel uncomfortable

Similarly to other aspects, around 40% of all respondents found this aspect highly concerning. There are low levels of concern for Italy, Greece and France, with 23% of Italian respondents being not at all concerned about it. The UK is once again the country with the highest number of respondents who are highly or very concerned and Finland having the lowest shares having little and no concern.

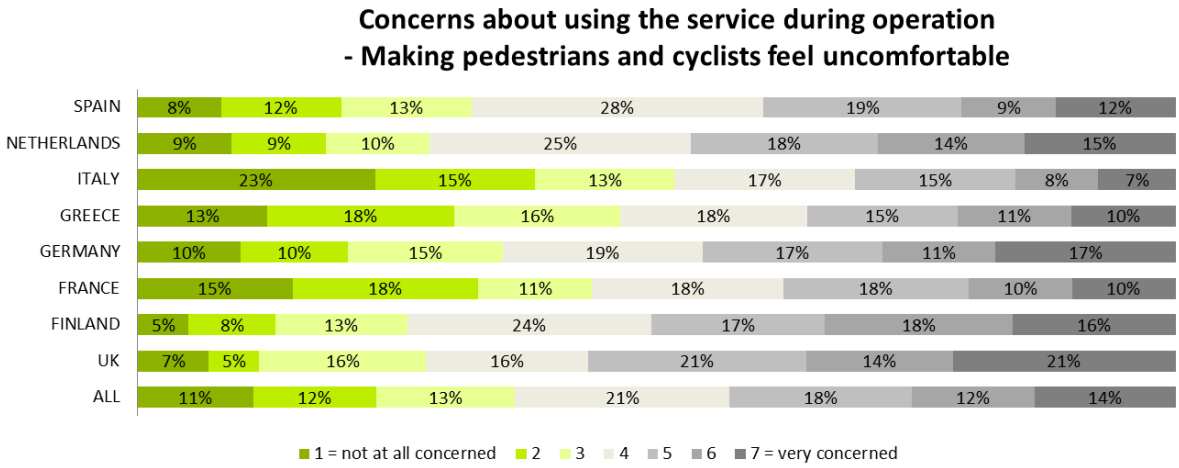



**Figure 51: Concerns – pedestrian comfort by country**

### 10.1.3.10 Malfunction or data loss affecting information

Corresponding with the concerns about aspects prior to operation, malfunction or data loss is the least concerning aspect during operation. There are similar country trends to other aspects, with Finland have the lowest proportions of no and little concern, and the UK having the highest share of those being very concerned. Italy and Greece are once again the least concerned, with around 50% of respondents having little or no concern.

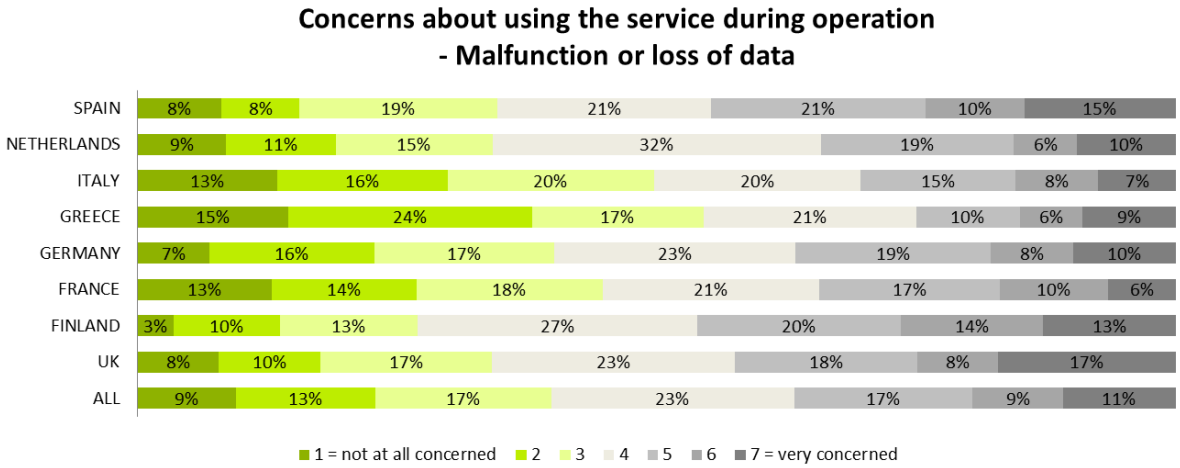



**Figure 52: Concerns – malfunction or loss of data by country**

### 10.1.3.11 Other Concerns

As with concerns prior to the service, there were also less than 10 % of respondents in every country who suggested any other concerns during the operation of the service. Nearly 80 % of these respondents were highly concerned and over half these were very concerned. The stated aspects were coded and presented in Table 4. Some stated concerns appear to reflect stated aspects, so the question may not have been fully understood. The highest number of concerns was related to safety, but many people also expressed a desire to be able to the stop the tour and spend time outside the vehicle. There was also a number of people who were uncomfortable with the general concept of automated driving so would not use the service at all.

**Table 4 - Other Concerns during operation of service**

| Concern | Number of Respondents |
|---|---|
| **Safety** | 33 |
| **Being able to stop to linger or if you feel ill** | 10 |
| **Malfunction** | 7 |
| **General concept of automated driving** | 8 |
| **Personal security / vehicle theft or damage / insurance** | 7 |
| **Cyber security** | 5 |
| **Being able to take over driving** | 5 |
| **Vehicle running out of charge** | 4 |
| **Comfort** | 4 |
| **Duration of trip** | 3 |
| **Breakdown or flat tyre** | 4 |
| **Data cost/use** | 2 |
| **Availability** | 1 |
| **Who to complain to if there is a malfunction** | 1 |

| | |
|---|---|
| **Don't know if it is operating correctly** | 1 |
| **Wrong route** | 1 |

### 10.1.4 **Evaluation of the perceived experience**

#### 10.1.4.1 Finland

**59%** of responders think scenario A is exciting (median=2), **51%** responded it is very useful (median=2) and **35%** that it is safe (median=3). Also, **46%** of respondents believed that the service described in scenario A is easy to use (median=3). Overall, the experience was positive, exciting, useful and easy. Some concerns about safety exist (median=3). Overall, the experience was positive, exciting, useful and easy. Some concerns about safety exist (median=3). Overall, the experience was positive, exciting, useful and easy. Some concerns about safety exist (median=3). Overall, the experience was positive, exciting, useful and easy. Some concerns about safety exist.

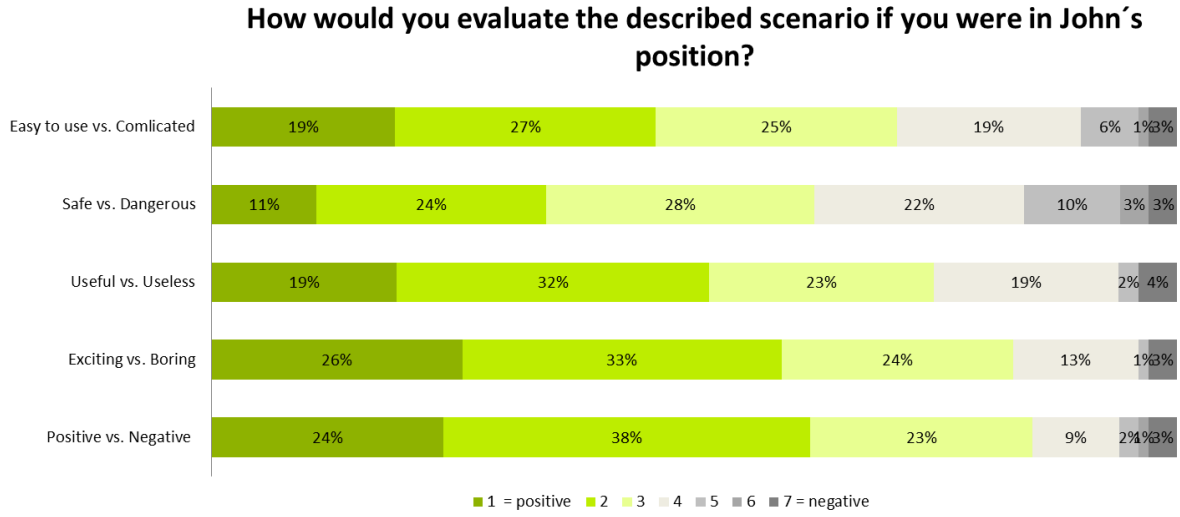



**Figure 53: Evaluation of scenario as being in John's position (Question 7) - Finland**

### 10.1.4.2 France

**63%** of the respondents replied that it is a positive experience versus a negative experience (median=2), **48%** of respondents think scenario A is exciting (median=3), **46%** responded it is very useful (median=3) and **37%** that it is safe (median=3). In addition, **55%** of respondents believed that scenario A is easy (median=2).

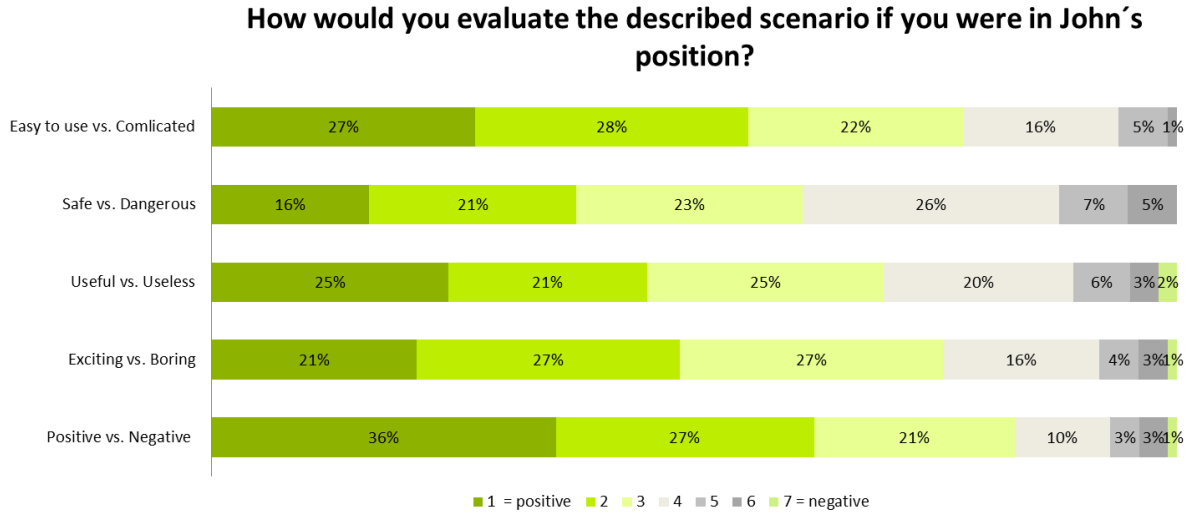



**Figure 54: Evaluation of scenario as being in John's position (Question 7) - France**

### 10.1.4.3 Germany

**61%** of the respondents replied that it is a positive experience versus negative experience (median=2), **57%** of respondents think scenario A is exciting (median=2), **55%** responded it is useful (median=2) and **37%** that it is safe (median=3). Also, **54%** of respondents believed that the service described in scenario A is easy (median=2). Overall, the scenario experience is perceived as positive, exciting, useful and easy. It is additionally perceived as safe, but some hesitations exist. This agrees with the overall finding.

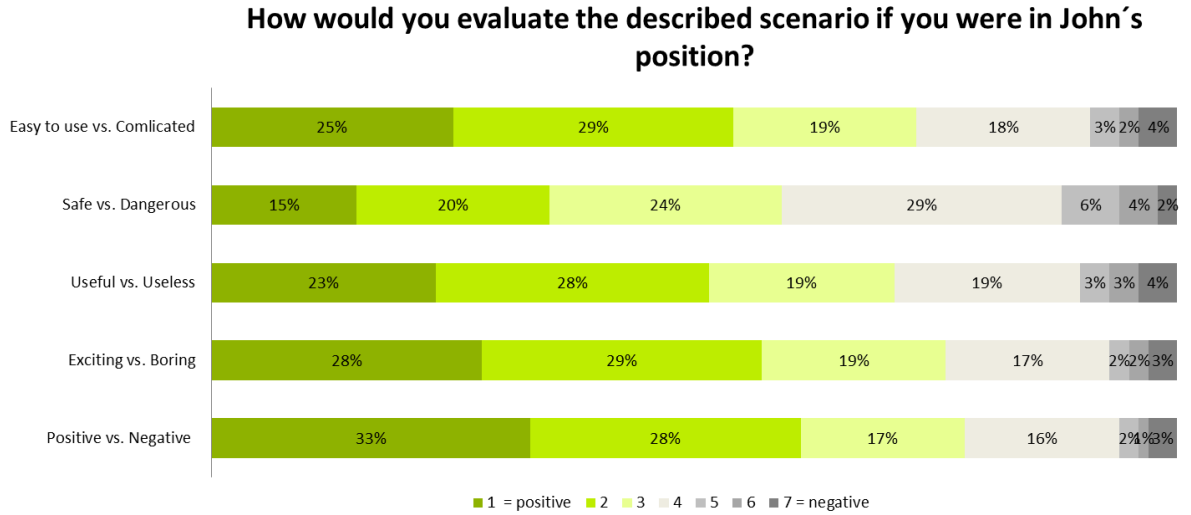



**Figure 55: Evaluation of scenario as being in John's position (Question 7) - Germany**

### 10.1.4.4 Greece

**60%** of the respondents replied that it is a positive experience versus negative experience (median=1), **73%** of respondents think the service described in scenario A is exciting (median=2), **55%** responded it is useful (median=2) and **52%** that it is safe (median=2). Also, **60%** of respondents believed that the service described in scenario A is easy to use (median=2). Overall, the experience was perceived as positive, easy and useful.

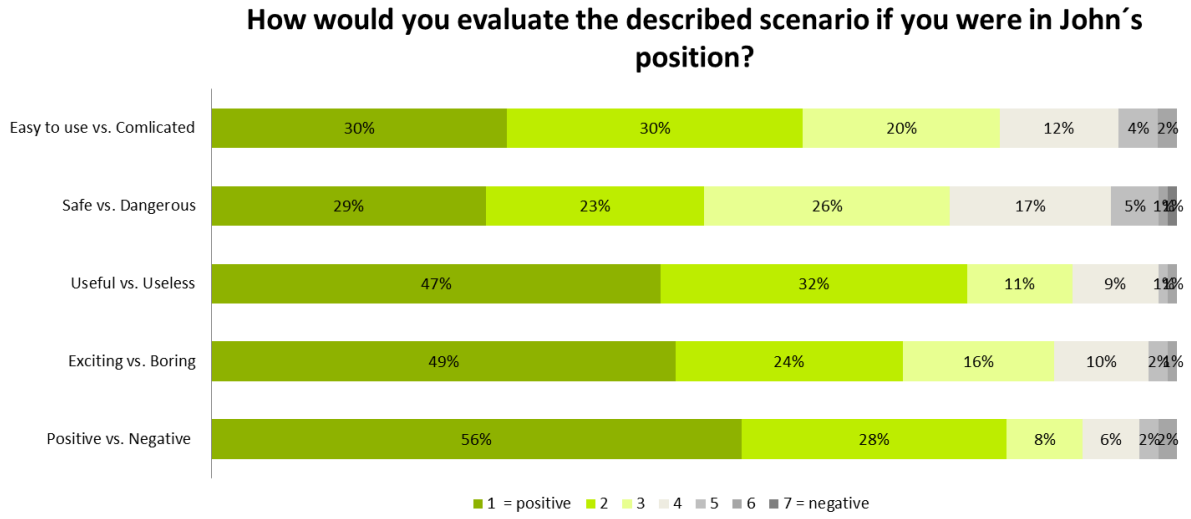



**Figure 56: Evaluation of scenario as being in John's position (Question 7) - Greece**

### 10.1.4.5 Italy

**60%** of the respondents replied that it is a positive experience versus negative experience (median=2), **68%** of respondents think the service described in scenario A is exciting (median=2), **71%** responded it is useful (median=2) and **40%** that it is safe (median=2). Also, **68%** of respondents believed that the service described in scenario A is easy (median=2). Again, the experience is perceived as safe but positive ratings are less when compared to the other categories (i.e. easiness, usefulness, positive experience, exciting).

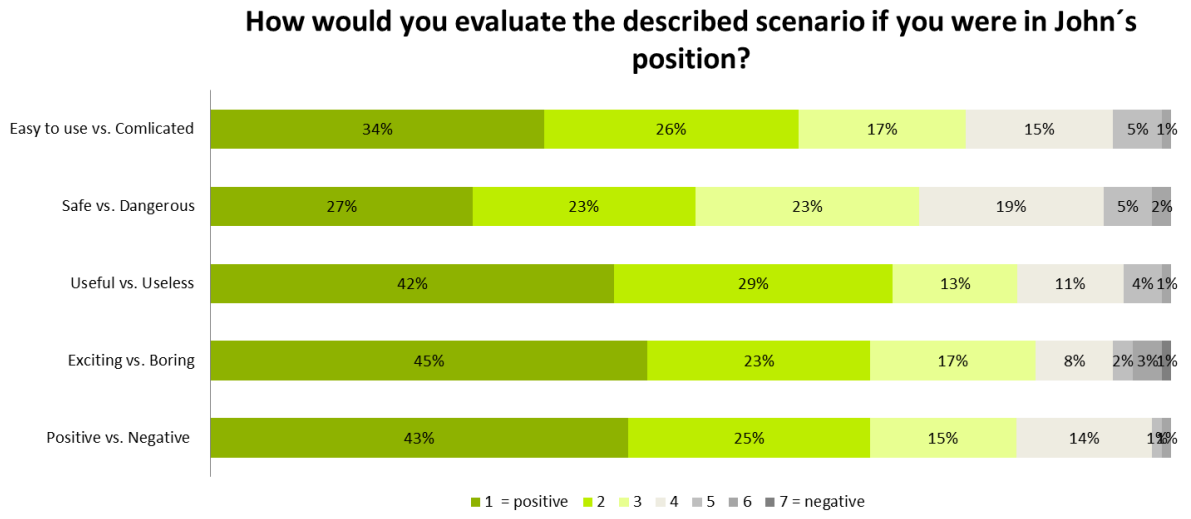



**Figure 57: Evaluation of scenario as being in John's position (Question 7) - Italy**

### 10.1.4.6 Netherlands

**59%** of the respondents replied that it is a positive experience versus negative experience (median=2), **55%** of respondents think the service described in scenario A is exciting (median=2), **59%** responded it is useful (median=2) and **26%** that it is safe (median=3). Also, **46%** of respondents believed that the service described in scenario A is easy to use (median=3). Dutch participants appear to perceive the self-driving vehicle experience as a safe and positive experience, useful, easy to use and exciting. It might be interesting to investigate which are the factors affecting this finding (i.e. if they are over-familiarised with diversity of vehicles in traffic, if there is increased awareness, etc.).

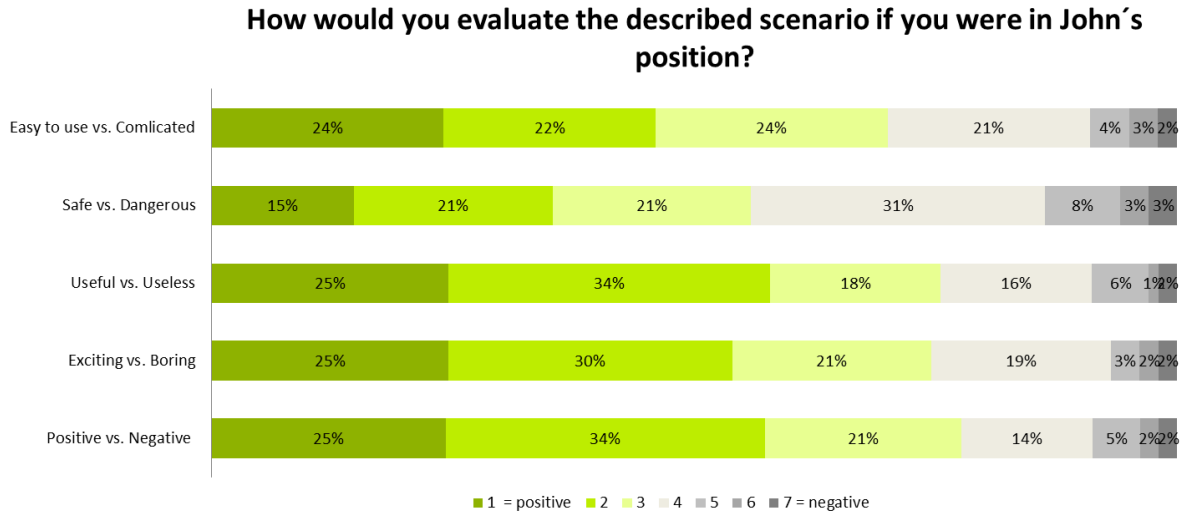



**Figure 58: Evaluation of scenario as being in John's position (Question 7) – The Netherlands**

### 10.1.4.7 Spain

**65%** of the respondents replied that it is a positive experience versus negative experience (median=2), **57%** of respondents think the service described in scenario A is exciting (median=2), **60%** responded it is useful (median=2) and **26%** that it is safe (median=3). Also, **48%** of respondents believed that the service described in scenario A is easy to use (median=2). The experience is perceived as easy to use, useful, a positive experience and safe. Apparently, on one hand, most respondents agree that the experience is safe, however, on the other hand, less do so strongly.

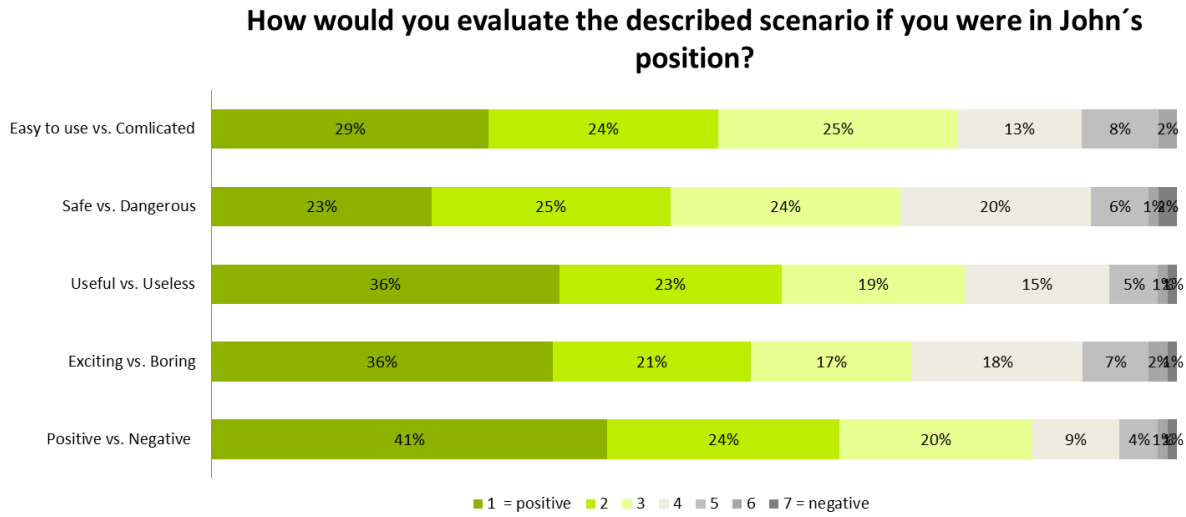



**Figure 59: Evaluation of scenario as being in John's position (Question 7) – Spain**

10.1.4.8 UK

**66%** of the respondents replied that the service described in Scenario A is a positive experience versus a negative experience (median=2), **62%** of respondents think the service described in scenario A is exciting (median=2), **60%** responded it is useful (median=2) and **39%** that it is safe (median=3). Also, **60%** of respondents believed that the service described in scenario A is easy to use (median=2).

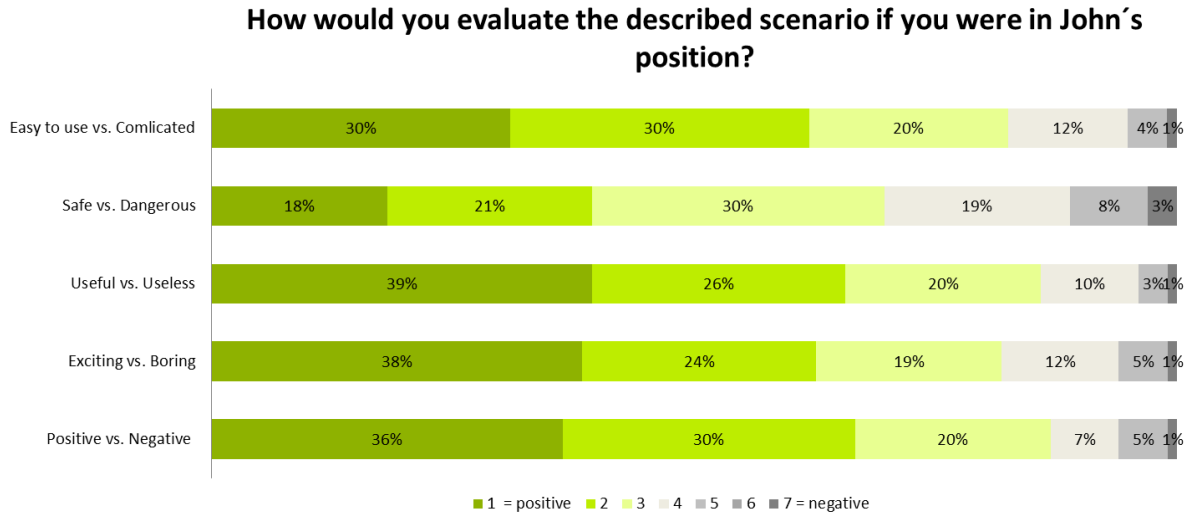



**Figure 60: Evaluation of scenario as being in John's position (Question 7) – UK**

### 10.1.5 Willingness to use the service and preferences toward using the service over other modes of transportation

#### 10.1.5.1 Finland

Almost **60%** of respondents replied that they would use the service offered if it was available and **14%** of users stating they would not use this service (median=3). Respondents wish to use the offered services, but they do not seem enthusiastic. **43%** of the respondents replied that they would prefer using the self-driving vehicle over a tourist bus (median=3), **27 %** over walking or cycling in the city and **26%** over doing the same thing in the Gardens (median=4), and **47%** more than renting a car in the city (median=3). It seems respondents would prefer to use the self-driving vehicle rather than renting a car, but this opportunity cannot replace walking or cycling or even taking a touristic bus.

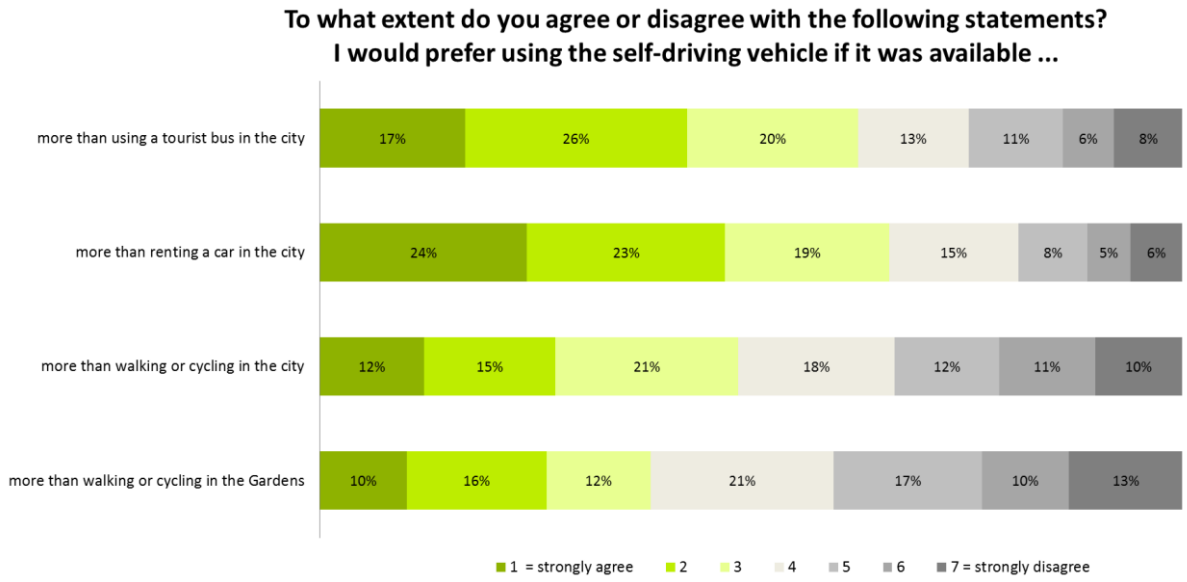



**Figure 61: Preferred situations/conditions of using a self-driving vehicle (Question 9) - Finland**

10.1.5.2 France

**62%** of respondents replied that they would use the service offered if it was available and **14%** of users stated they would not use this service (median=3). **52 %** of the respondents replied that they would prefer using the self-driving vehicle over a tourist bus (median=2), **35 %** over walking or cycling in the city (median=3) and **23 %** over doing the same thing in the Gardens (median=4), and **54 %** more than renting a car in the city (median=2).

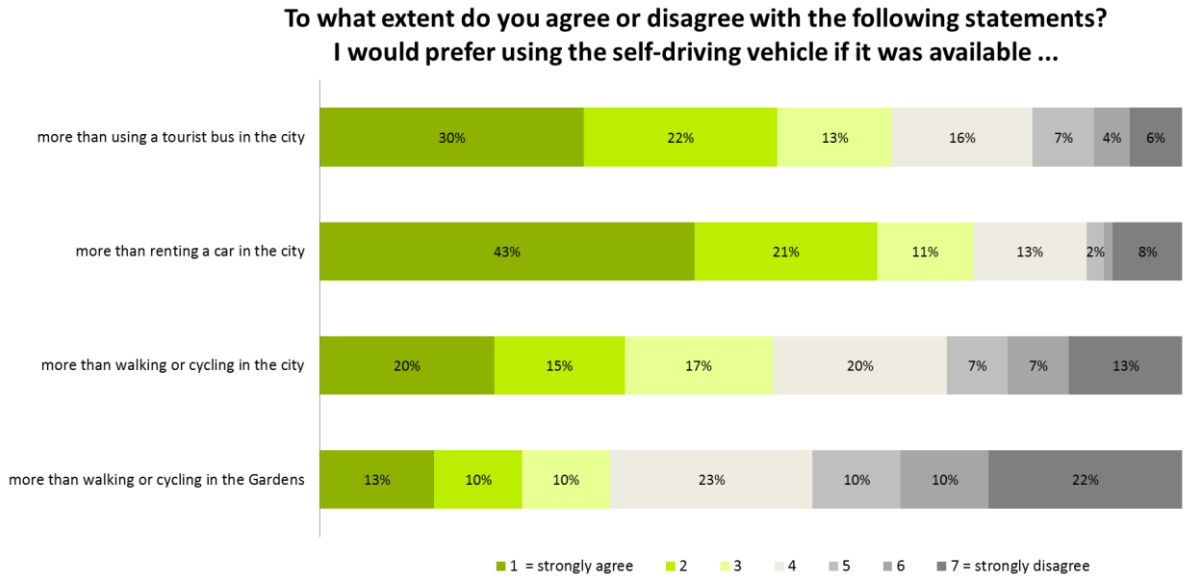



**Figure 62: Preferred situations/conditions of using a self-driving vehicle (Question 9) - France**

10.1.5.3 Germany

**69%** of respondents replied that they would use the service offered if it was available and **13%** of users stating they would not use this service (median=3). **46%** of the respondents replied that they would prefer using the self-driving vehicle over using a tourist bus (median=3), **38 %** over walking or cycling in the city (median=3) and **26%** over doing the same thing in the Gardens (median=4), and **49%** more than renting a car in the city (median=3). Using another vehicle (i.e. touristic bus and/ or rented car are least preferred when compared to the self-driving vehicle experience.

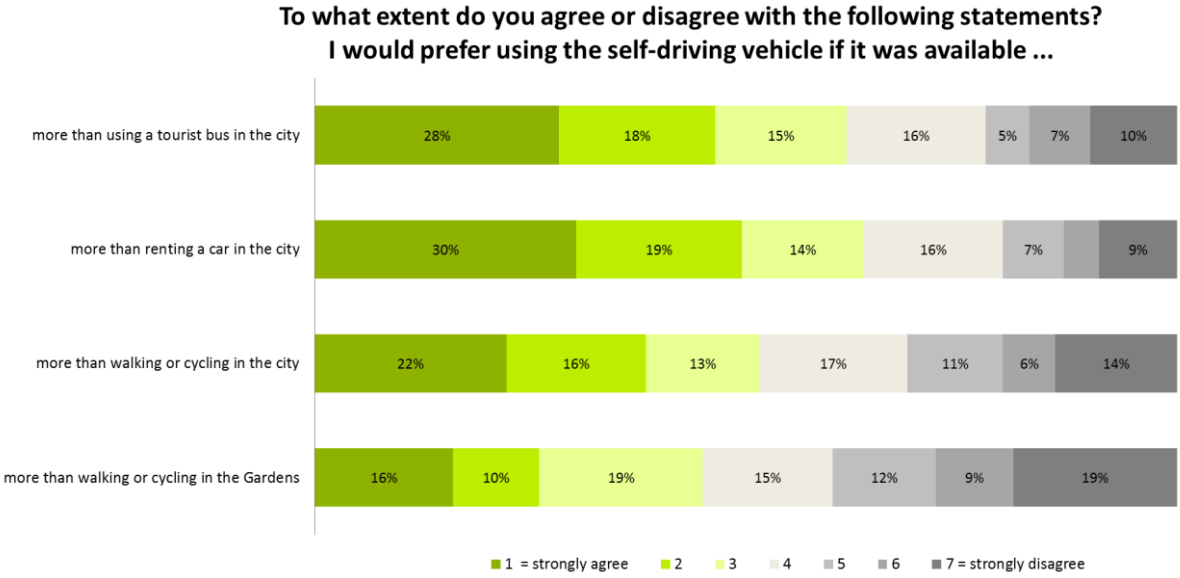



**Figure 63: Preferred situations/conditions of using a self-driving vehicle (Question 9) - Germany**

### 10.1.5.4 Greece

**75 %** of respondents replied that they would use the service offered if it was available and **2 %** of users stating they would not use this service (median=2). **71%** of the respondents replied that they would prefer using the self-driving vehicle over using a tourist bus (median=2), **46%** over walking or cycling in the city (median=3) and **43%** over doing the same thing in the Gardens (median=3), and **68%** over renting a car in the city (median=1). Again, the touristic bus and the rented car are preferred less than the self-driving vehicle experience.

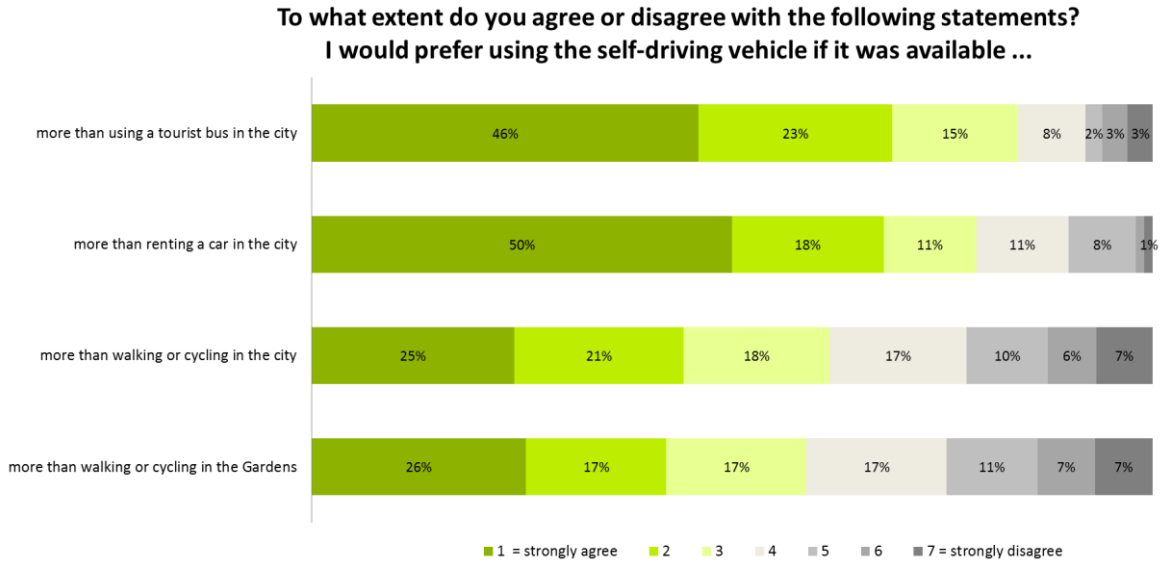



**Figure 64: Preferred situations/conditions of using a self-driving vehicle (Question 9) - Greece**

### 10.1.5.5 Italy

**66 %** of respondents replied that they would use the service offered if it was available and **5 %** of users stating they would not use this service (median=3). **54 %** of the respondents replied that they would prefer suing the self-driving vehicle over using a tourist bus (median=2), **36 %** over walking or cycling in the city (median=3) and **28 %** over doing the same thing in the Gardens (median=4), and **62 %** more than renting a car in the city (median=2). Similarly to previous findings, the self-driving vehicle experience in the Versailles Gardens is preferred over the touristic bus and the rented car around the city.

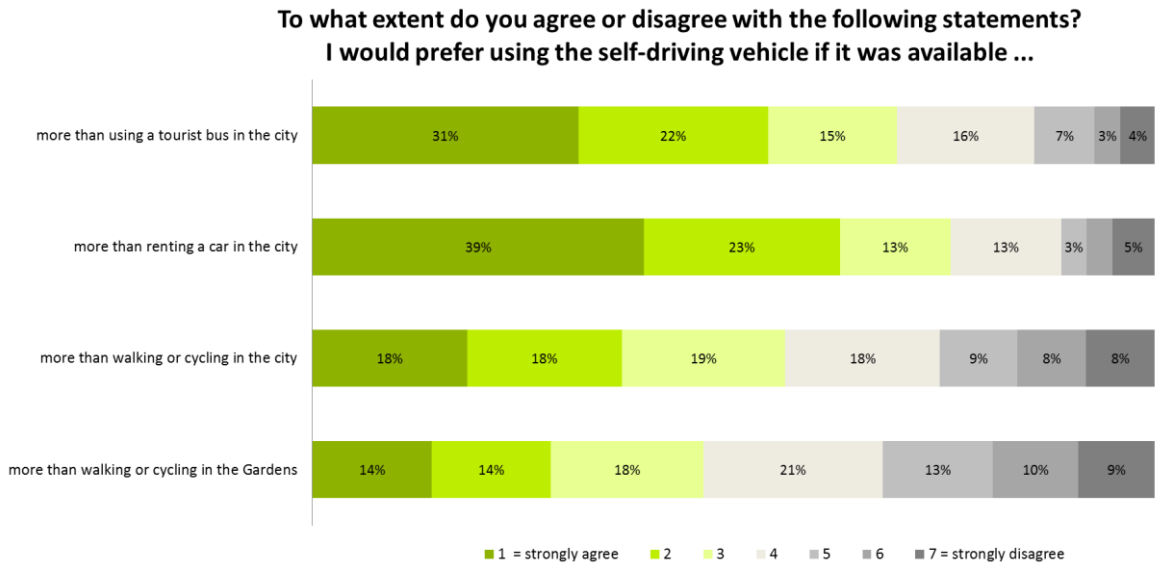



**Figure 65: Preferred situations/conditions of using a self-driving vehicle (Question 9) - Italy**

10.1.5.6 Netherlands

**57 %** of respondents replied that they would use the service offered if it was available and **15 %** of users stating they would not use this service (median=3). **38 %** of the respondents replied that they would prefer using the self-driving vehicle over using a tourist bus (median=3), **28 %** over walking or cycling in the city (median=4) and **23 %** over doing the same thing in the Gardens (median=4), and **47 %** more than renting a car in the city (median=3). Similarly to other countries, the self-driving vehicle is preferred over a touristic bus and/ or a rental car, but it is the lowest scoring preferences across all countries. It could be speculated that walking and cycling might be viewed differently by Dutch respondents, but an open question could provide more insight.

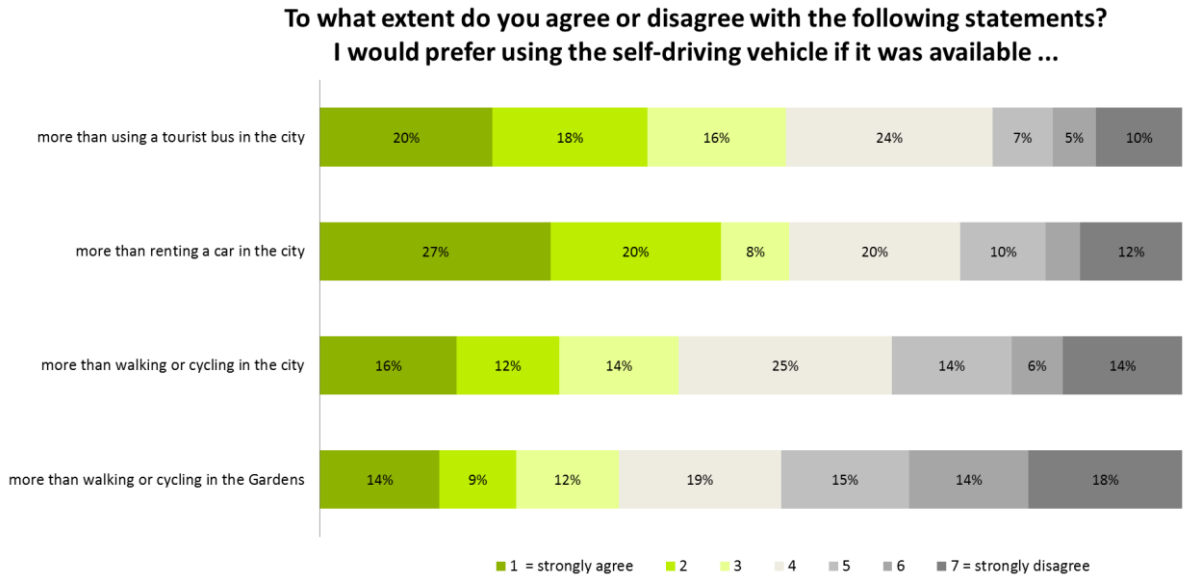



**Figure 66: Preferred situations/conditions of using a self-driving vehicle (Question 9) – The Netherlands**

10.1.5.7 Spain

**68 %** of respondents replied that they would use the service offered if it was available and **6 %** of users stating they would not use this service (median=3). **47 %** of the respondents replied that they would prefer using the self-driving vehicle over using a tourist bus (median=2), **38 %** over walking or cycling in the city (median=2) and **23 %** over doing the same thing in the Gardens (median=2), and **31 %** more than renting a car in the city (median=3). More respondents would prefer the self-driving vehicle over renting a car in the city. However, using the self-driving vehicle is equally preferred over taking the touristic bus and walking/cycling in the city.

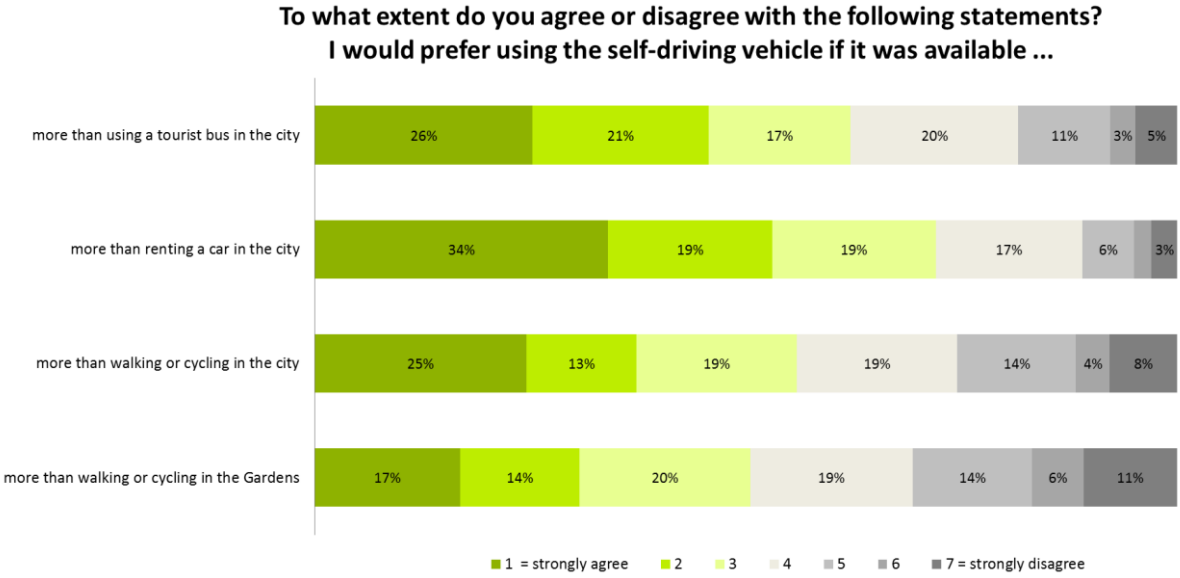



**Figure 67: Preferred situations/conditions of using a self-driving vehicle (Question 9) – Spain**

10.1.5.8 UK

**68 %** of respondents replied that they would use the service offered if it was available and **13 %** of users stating they would not use this service (median=3). **43 %** of the respondents replied that they would prefer using the self-driving vehicle over using a tourist bus (median=3), **25 %** over walking or cycling in the city (median=3) and **28 %** over doing the same thing in the Gardens (median=4), and **54 %** over renting a car in the city (median=2). Participants in UK do not seem very eager to use the self-driving vehicle in the Versailles Garden but rather use it for an extensive sightseeing experience. The touristic bus and rental car are least preferred over the self-driving vehicle experience.

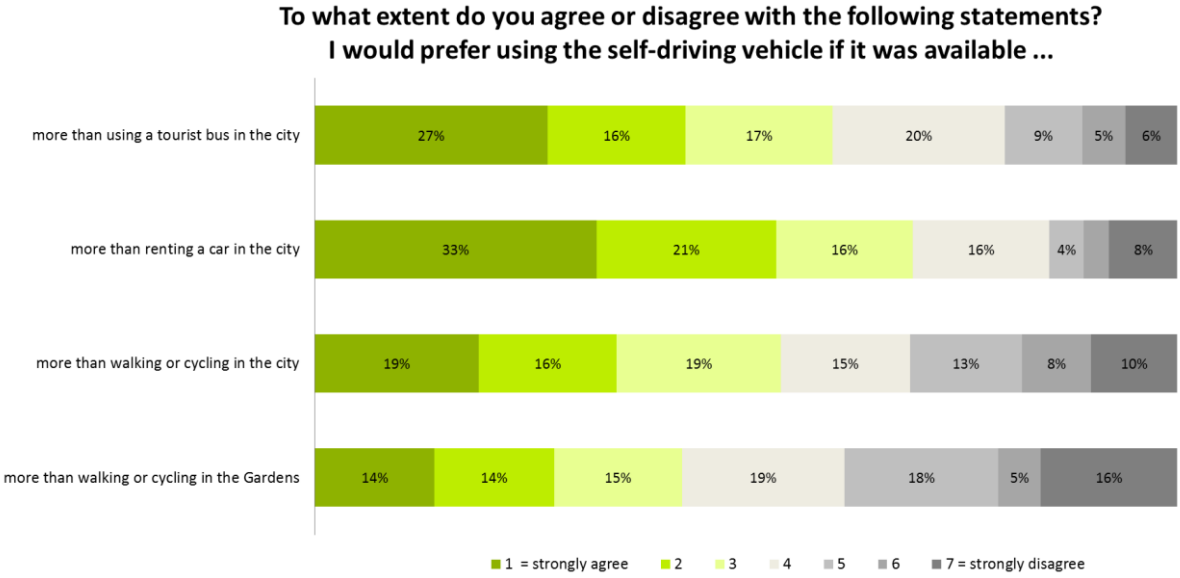



**Figure 68: Preferred situations/conditions of using a self-driving vehicle (Question 9) – UK**

### 10.1.6 **Preferences toward sharing data to use the service**

**Finland**

**69 %** of the respondents are willing to provide name and surname, **68 %** prefer to register with an existing account, **41 %** agree to provide their email address, **41 %** would use a nickname ,**36 %** would allow access to their smartphone's microphone, **35 %** would allow access to their location (i.e. GPS), **30%** would provide their vehicle's license number, **24 %** would share their payment data (bank account, credit card), **19 %** other payment options (e.g. PayPal), and **15 %** activation of Bluetooth on the smartphone. In addition, **25 %** respondents agree to share other types of information to be granted access to the service.

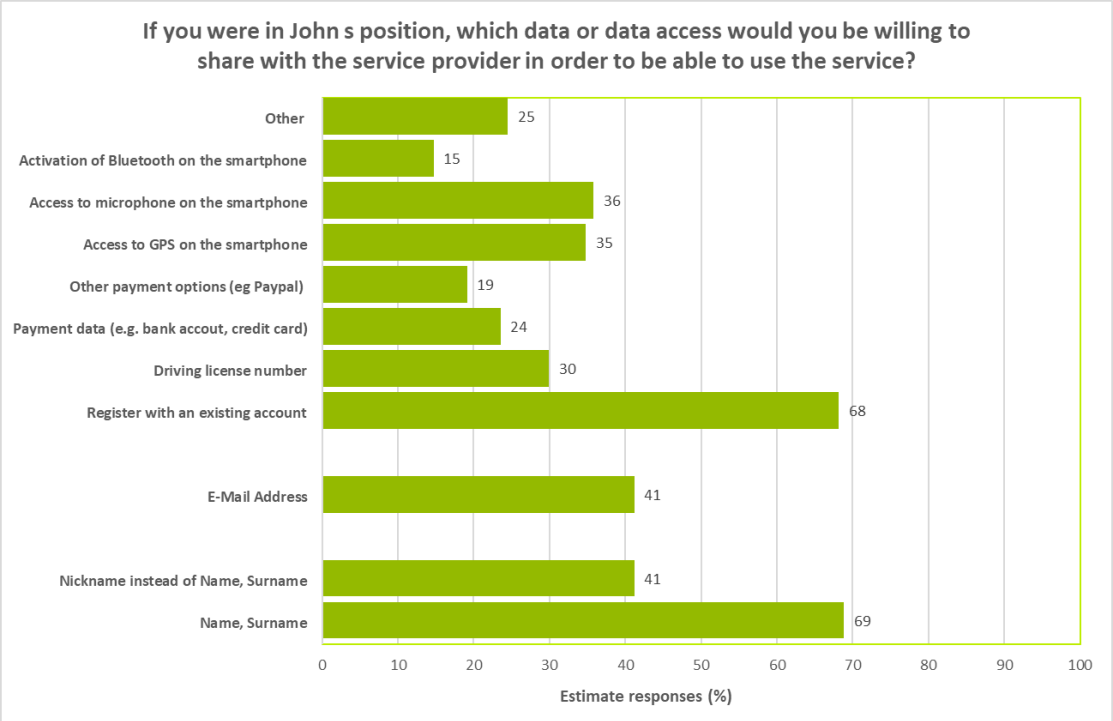



**Figure 69: Data types willing to share to access the service (Finland)**

**France**

**47%** of the respondents are willing to provide name and surname, **68%** prefer to register with an existing account, **64%** agree to provide their email address, **60 %** would use a nickname, **26%** would allow access to their smartphone's microphone, **38%** would allow access to their location (i.e. GPS), **32%** would provide their vehicle's license number, **15%** would share their payment data (bank account, credit card), **32%** other payment options (e.g. PayPal), and **26%** activation of Bluetooth on the smartphone. In addition, **3%** respondents they would prefer to share other types of information, including one person who stated that they would share their home address. 6 respondents stated that they would not give access to any of their data. The email address and an existing account are the preferred registration method.

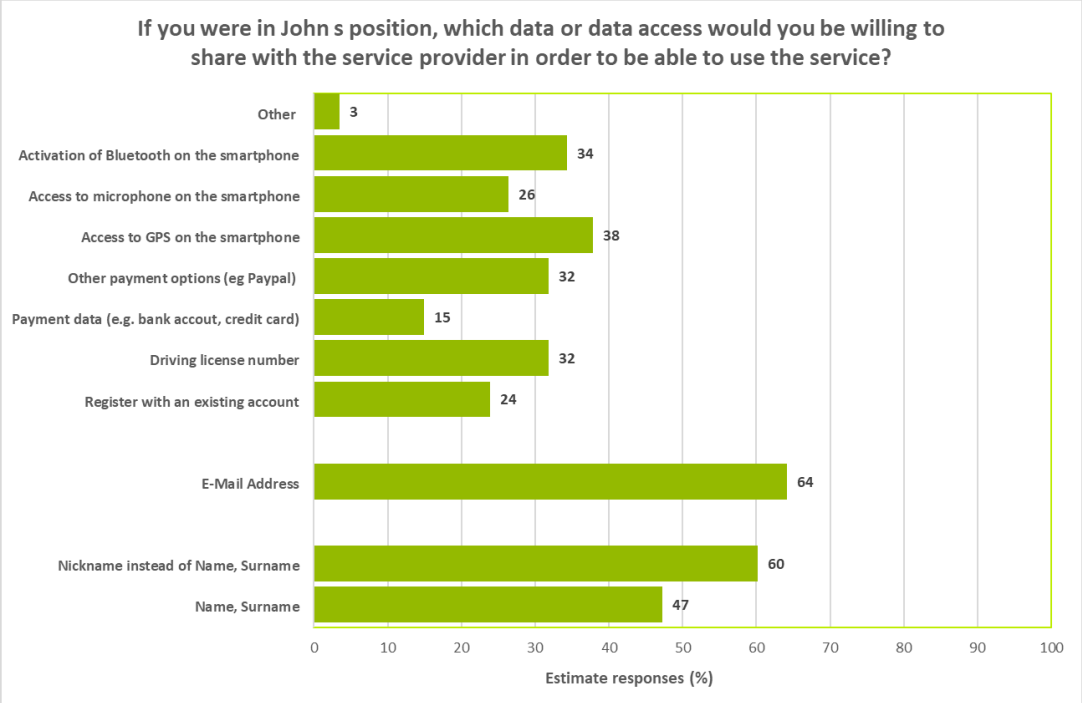



**Figure 70: Data types willing to share to access the service (France)**

**Germany**

**79%** of the respondents are willing to provide name and surname, **15%** prefer to register with an existing account, **76%** agree to provide their email address, **23%** would use a nickname, **25%** would allow access to their smartphone's microphone, **41%** would allow access to their location (i.e. GPS), **45%** would provide their vehicle's license number, **29%** would share their payment data (bank account, credit card), **49%** other payment options (e.g. PayPal), and **30%** activation of Bluetooth on the smartphone. In addition, **6%** of respondents would prefer to share other types of information, including home address, or hotel address for tourists. 6 respondents stated that they would not give access to any of their data. Most respondents prefer to use their own personal details to register (i.e. name/surname) and they are reluctant to share their bank details. The latter finding agrees with the overall finding but the first does not.

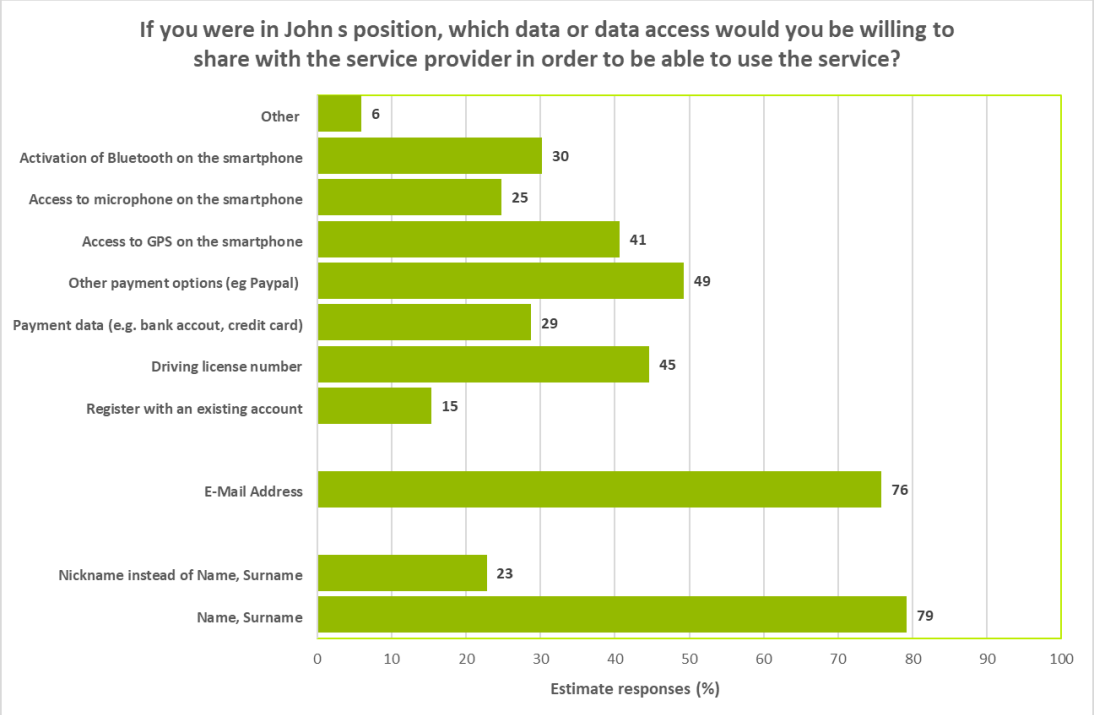



**Figure 71: Data types willing to share to access the service (Germany)**

**Greece**

**59%** of the respondents are willing to provide name and surname, **47%** prefer to register with an existing account, **81%** agree to provide their email address, **54%** would use a nickname, **39%** would allow access to their smartphone's microphone, **56%** would allow access to their location (i.e. GPS), **33%** would provide their vehicle's license number, **19%** would share their payment data (bank account, credit card), **64%** other payment options (e.g. PayPal), and **39%** activation of Bluetooth on the smartphone. In addition, **6%** of respondents stated that they would not give access to any of their data. Email address is the preferred registration method. The same reluctance to share bank details is evident here as with other countries.

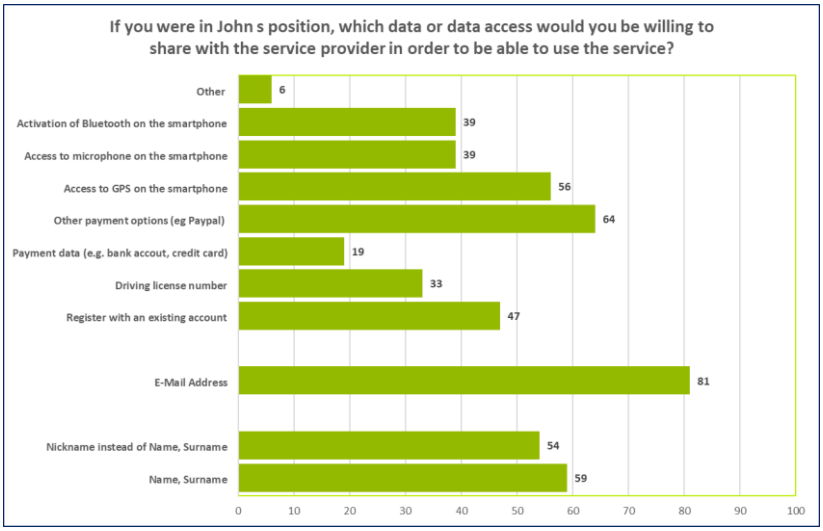



**Figure 72: Data types willing to share to access the service (Greece)**

**Italy**

In Question 10, "*If you were in John's position, which data or data access would you be willing to share with the service provider in order to be able to use the service?*", as shown in Error! Reference s ource not found.**, 25%** of the respondents are willing to provide name and surname, **30%** prefer to register with an existing account, **76%** agree to provide their email address, **25%** would use a nickname, **23%** would allow access to their smartphone's microphone, **35%** would allow access to their location (i.e. GPS), **39%** would provide their vehicle's license number, **23%** would share their payment data (bank account, credit card), **51%** other payment options (e.g. PayPal), and **23%** activation of Bluetooth on the smartphone. In addition, **2%** of respondents stated that they would not give access to any of their data. Again, the email address is the preferred registration method and users are once more reluctant to share bank details.

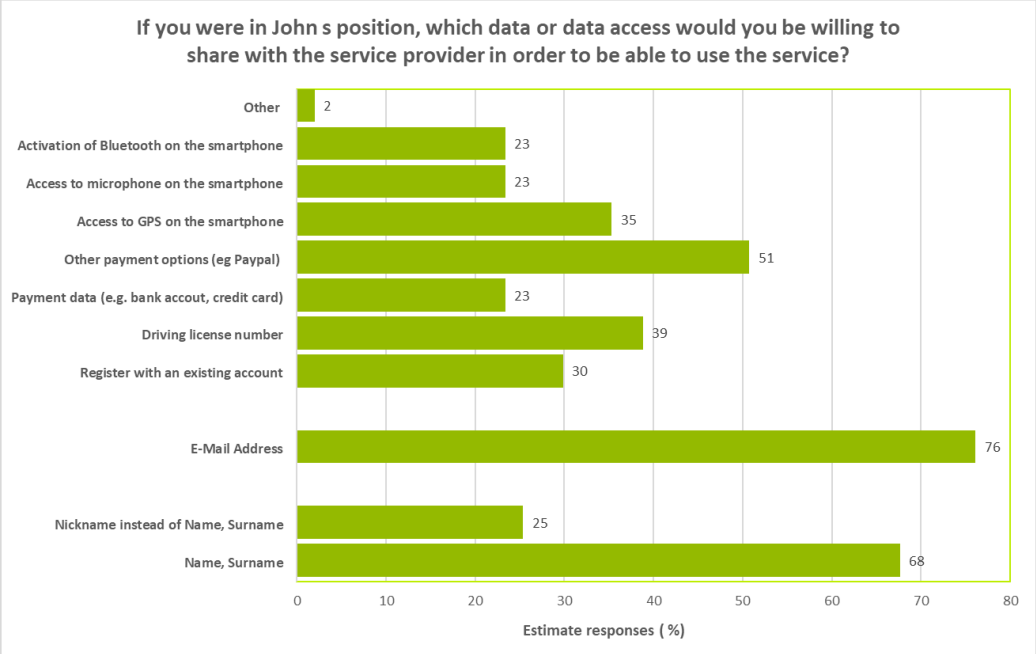



**Figure 73: Data types willing to share to access the service (Italy)**

**Netherlands**

**68%** of the respondents are willing to provide name and surname, **13%** prefer to register with an existing account, **73%** agree to provide their email address, **23%** would use a nickname, **17%** would allow access to their smartphone's microphone, **38%** would allow access to their location (i.e. GPS), **34%** would provide their vehicle's license number, **25%** would share their payment data (bank account, credit card), **22%** other payment options (e.g. PayPal), and **21%** activation of Bluetooth on the smartphone. In addition, **3%** of respondents stated that they would not give access to any of their data. Again, most respondents prefer to register with their email addresses.

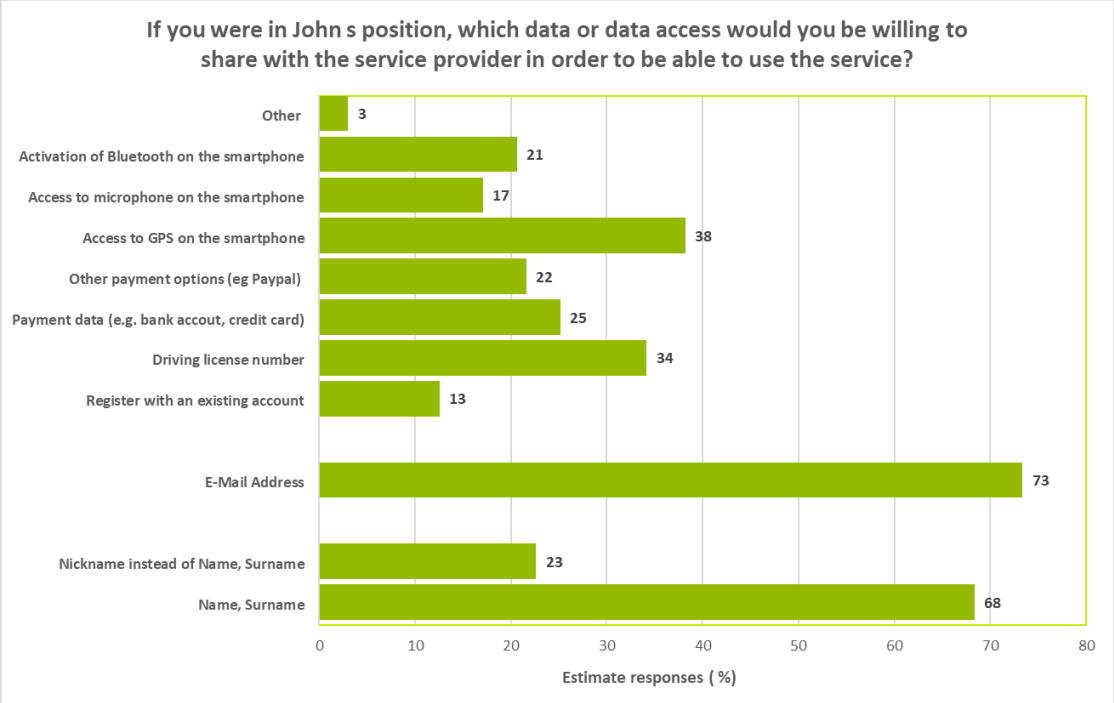



**Figure 74: Data types willing to share to access the service (The Netherlands)**

**Spain**

**63%** of the respondents are willing to provide name and surname, **25%** prefer to register with an existing account, **79%** agree to provide their email address, **38%** would use a nickname, **21%** would allow access to their smartphone's microphone, **37%** would allow access to their location (i.e. GPS), **42%** would provide their vehicle's license number, **35%** would share their payment data (bank account, credit card), **53%** other payment options (e.g. PayPal), and **29%** activation of Bluetooth on the smartphone. In addition, **1%** of respondents stated that they would not give access to any of their data. Email address, once more, is preferred for registration to the service.

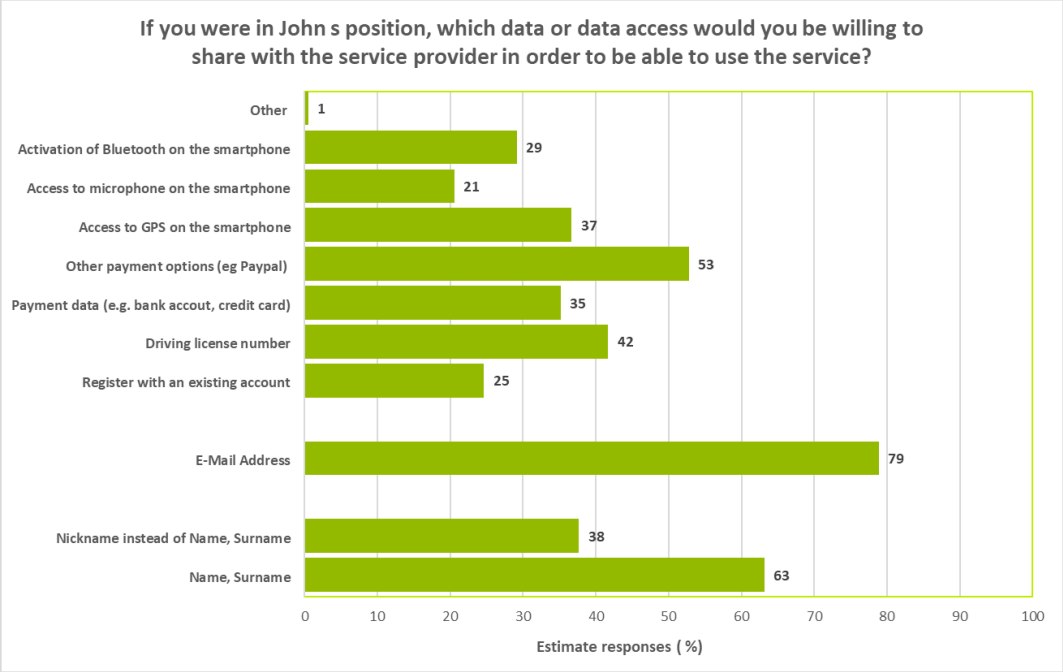



**Figure 75: Data types willing to share to access the service (Spain)**

**UK**

**59%** of the respondents are willing to provide name and surname, **47%** prefer to register with an existing account, **81%** agree to provide their email address, **54%** would use a nickname, **39%** would allow access to their smartphone's microphone, **56%** would allow access to their location (i.e. GPS), **33%** would provide their vehicle's license number, **19%** would share their payment data (bank account, credit card), **64%** other payment options (e.g. PayPal), and **39%** activation of Bluetooth on the smartphone. In addition, **6%** of respondents stated that they would not give access to any of their data. Registration with an email address is preferred.

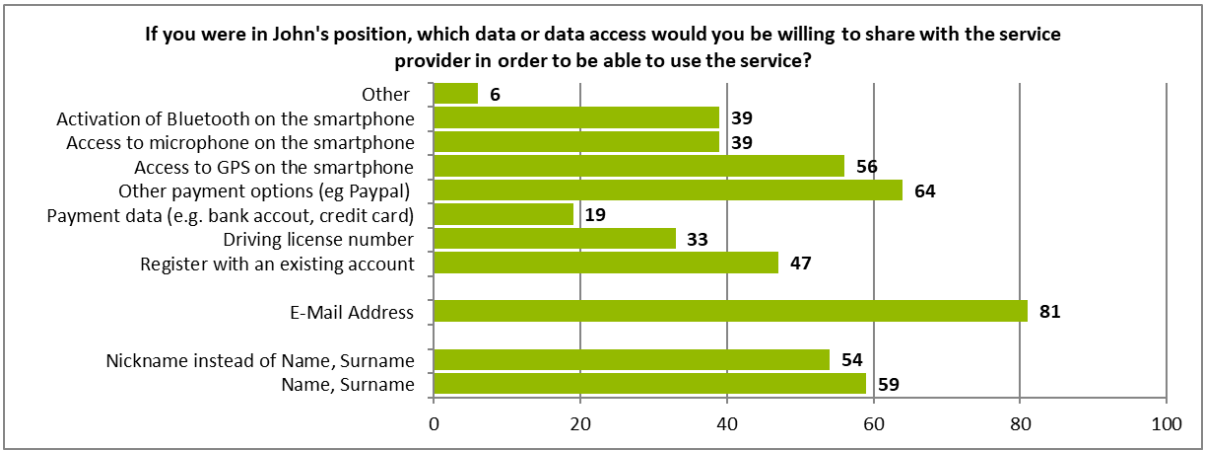


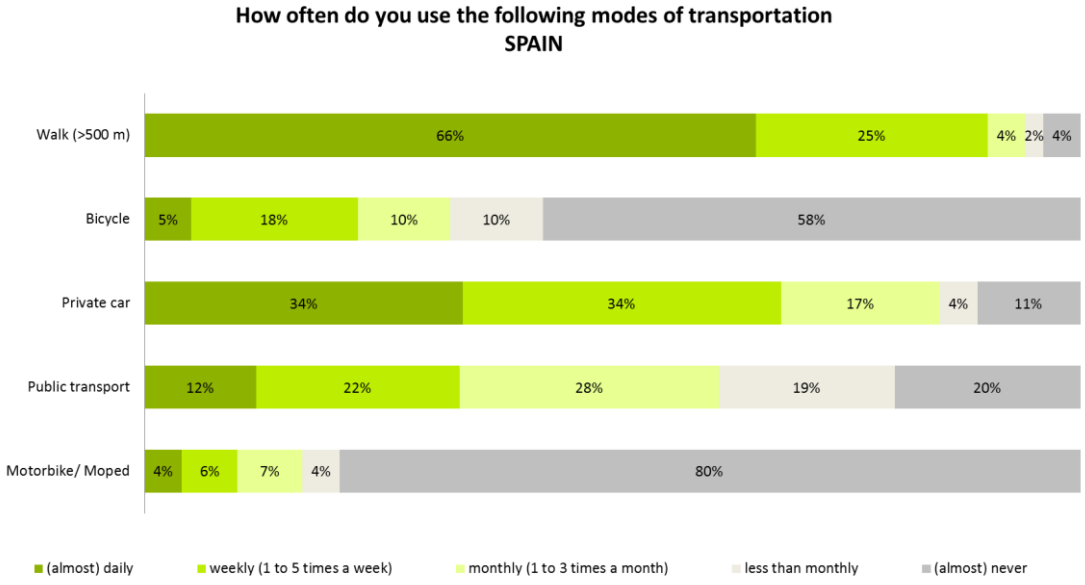

**Figure 76: Data types willing to share to access the service (UK)**

## 10.2 Scenario A: Detailed descriptive analysis of the survey in tables

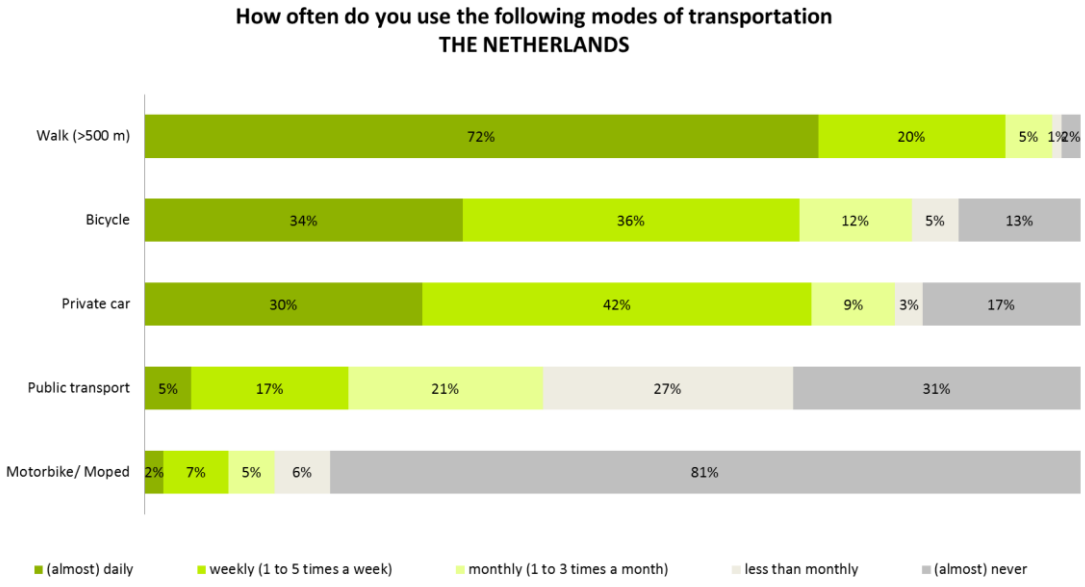
### 10.2.1 Mobility behaviour

To describe the mobility behaviour of the respondents with a strong focus on their mode choice, a question on the frequency of the use of different travel modes was set. The results are presented for each country. An average use for the whole sample would not be useful as mode choices depend strongly among other factors on the geographical characteristics and mobility market in the selected countries.

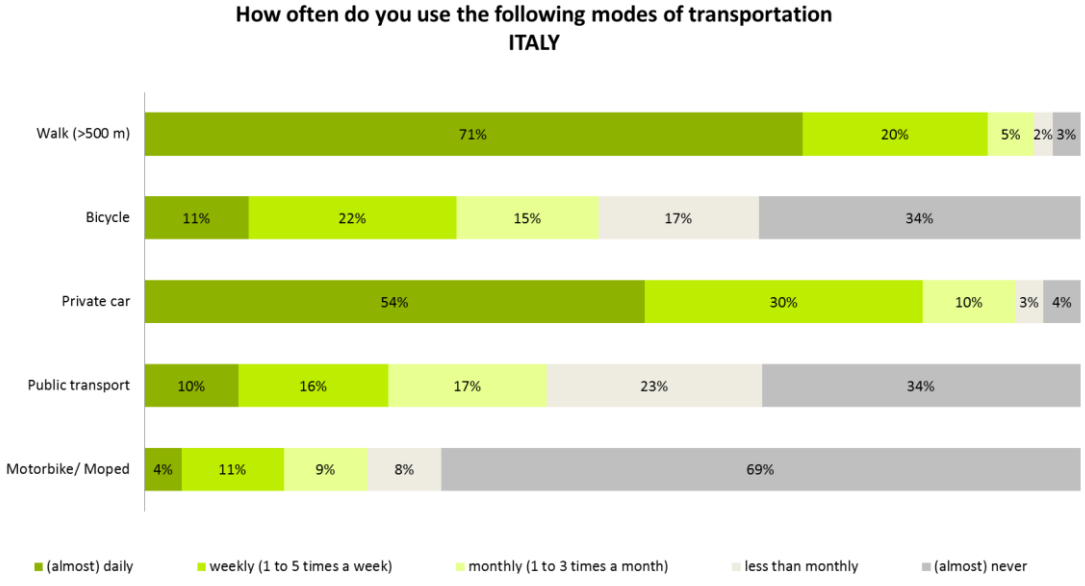
In **Spain** a private car is the most frequently used motorised mode of transport. From the active travel modes, a strong preference for walking can be seen. Bicycles are not used on a regular basis. In fact, more than half of the respondents (58 %) stated that they (almost) never use a bicycle. The frequency of public transport use differs in this sample. Only a third (34 %) of the respondents reported that they use public transport (almost) daily or weekly. Motorbike and mopeds are, similarly as in the other countries, the least frequently used mode of transportation.



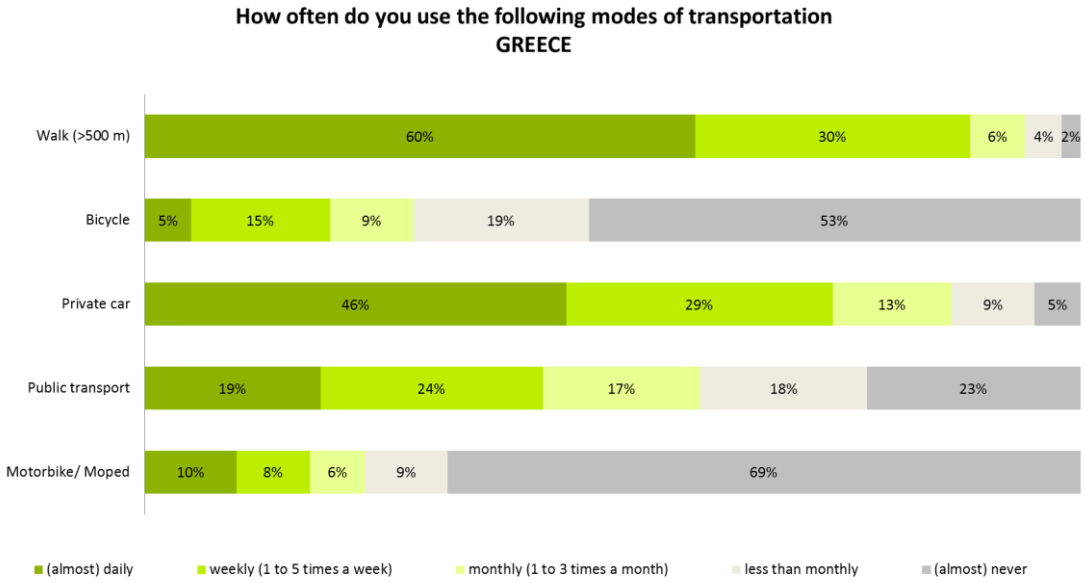
In the **Netherlands**, contrary to most of the other countries, there is a very frequent use of the bicycle, which is used as frequently as a private car. Also walking is a frequently used alternative in the everyday life. Public transport seems to play a less important role.



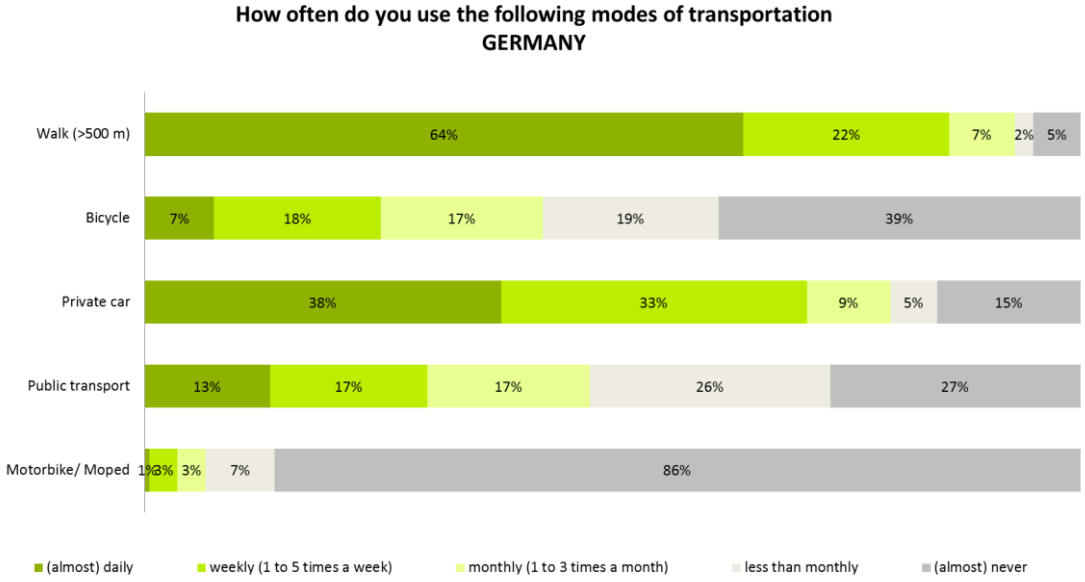

In **Italy**, the travel mode most frequently used by the survey sample is the private car. Walk, also in the other countries, could be considered as an access/ egress mode of transport. However, no multimodal trips are addressed in the survey and hence, this remains only an assumption. Bicycles are more frequently used as in Spain, but don´t reach the high use frequency as in the Netherlands. Also here public transport plays a smaller role than the private car, but it seems to be used by more persons than in the Netherlands.



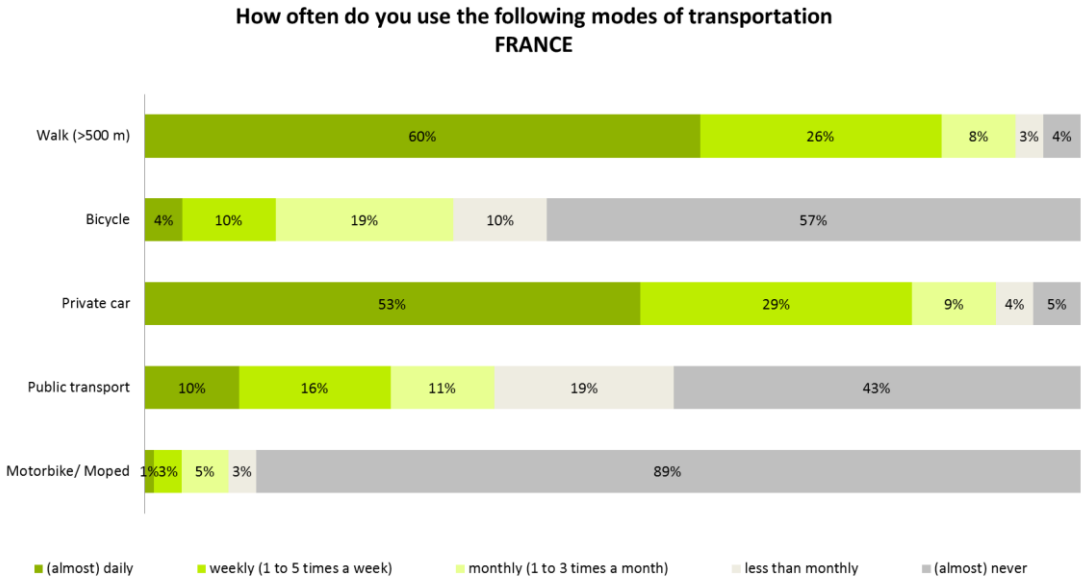
In **Greece,** similar to the other countries, the private car is the most frequently used travel mode. In Greece, public transport is used more frequently than in the other countries. Bicycles play a rather small role in the everyday mobility patterns.



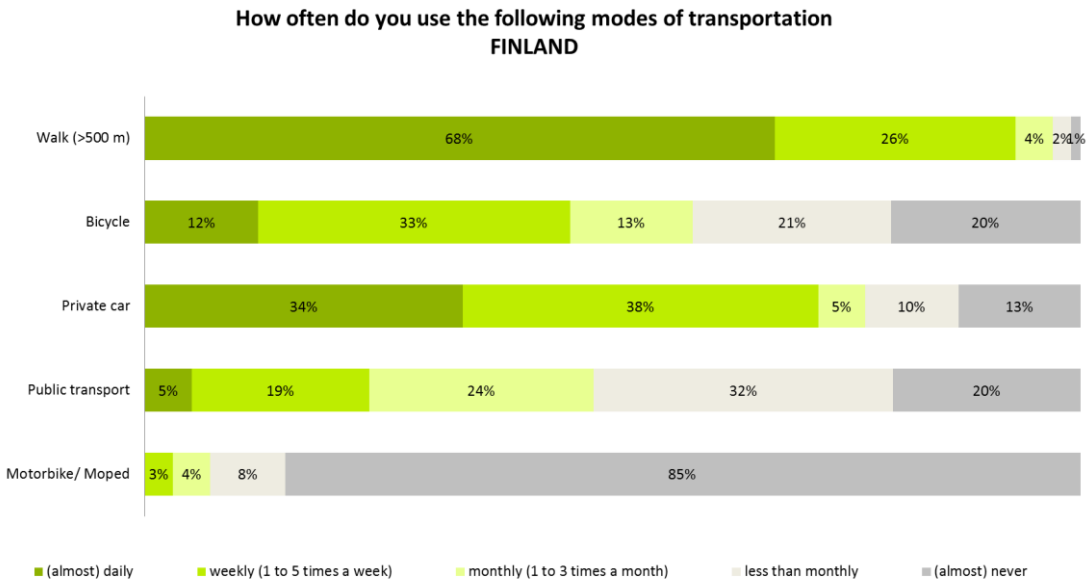

In **Germany** the private car plays an important role in everyday mobility as well. However, it is less frequently used than in other countries, such as for instance in France or in Italy. Public transport is preferred among using the bicycle. However, also here, no multimodal patterns were considered. At the same time, active modes of transport are in some cases combined with the usage of public transport.



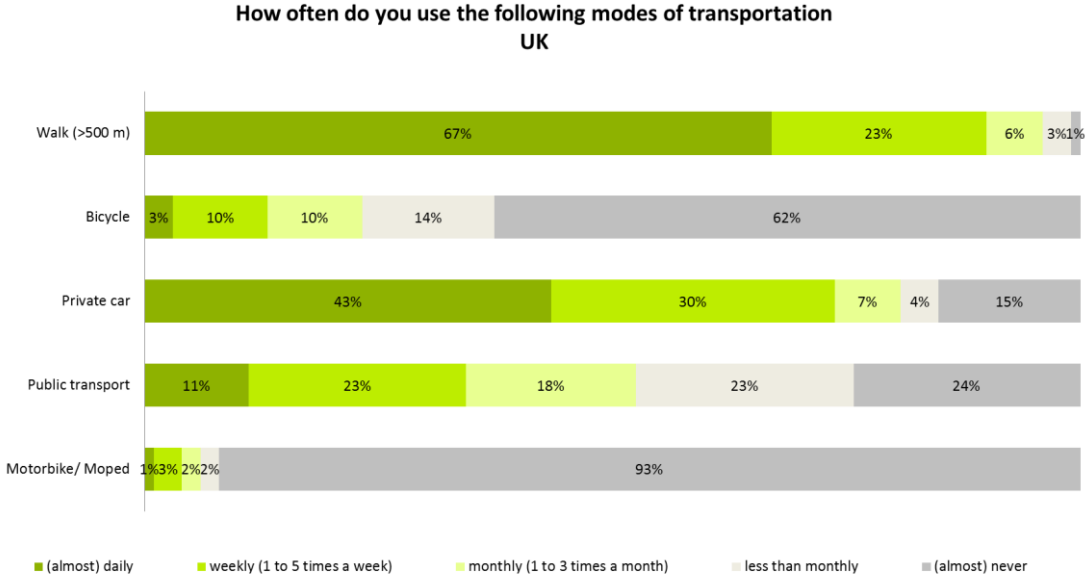
In **France**, the private car is the most frequently used mode of transport. More than half of the respondents in France (53%) reports that they use the private car (almost) every daily, while only 10% of the sample state using the public transport on a daily basis. The bicycle plays a rather less important role – about 57% of the respondents in France use it (almost) never.




In **Finland** public transport is also less frequently used than a private car. The bicycle is used by one third of the sample at least weekly. Note that the reported values give only a tendency how frequent different modes of transportation are used on average in the selected countries. At the same time, the modal split depends strongly also on spatial characteristics and hence, comparing urban and rural areas in the selected countries might show very different picture than the average values presented here.



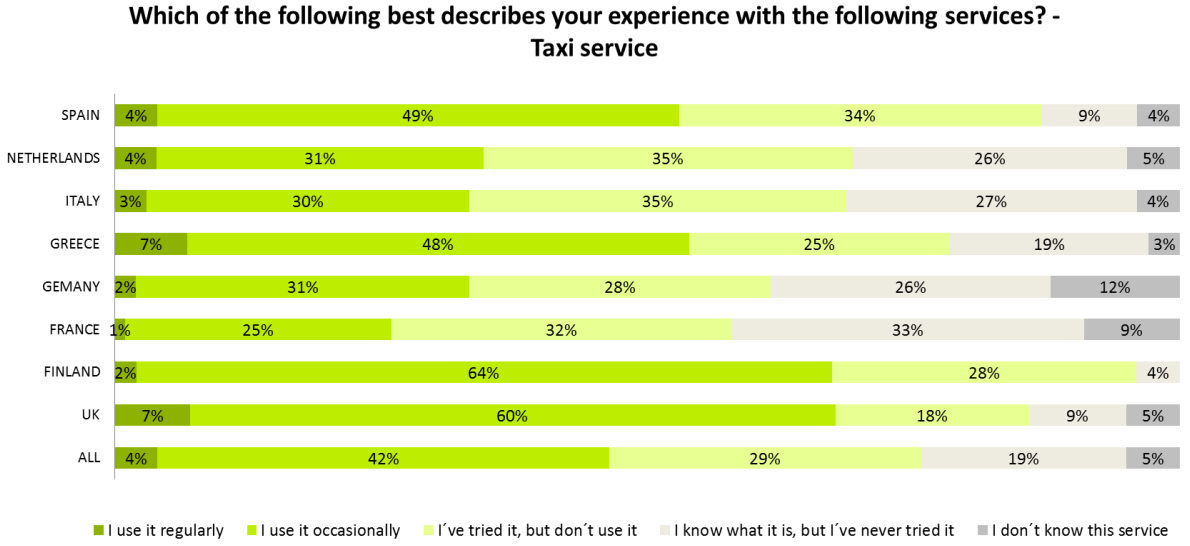
In the **UK,** the frequency of the daily use of a car is among the highest values for the selected countries after France, Italy and Greece. The frequency of using public transport is distributed over the sample – about a third (34 %) report using it daily or at least weekly while almost half (47 %) report using it less than monthly or (almost) never.




### 10.2.2 Experience with mobility services

Respondents were asked about their experience and frequency of use of different mobility services, such as taxi, carsharing and UBER.

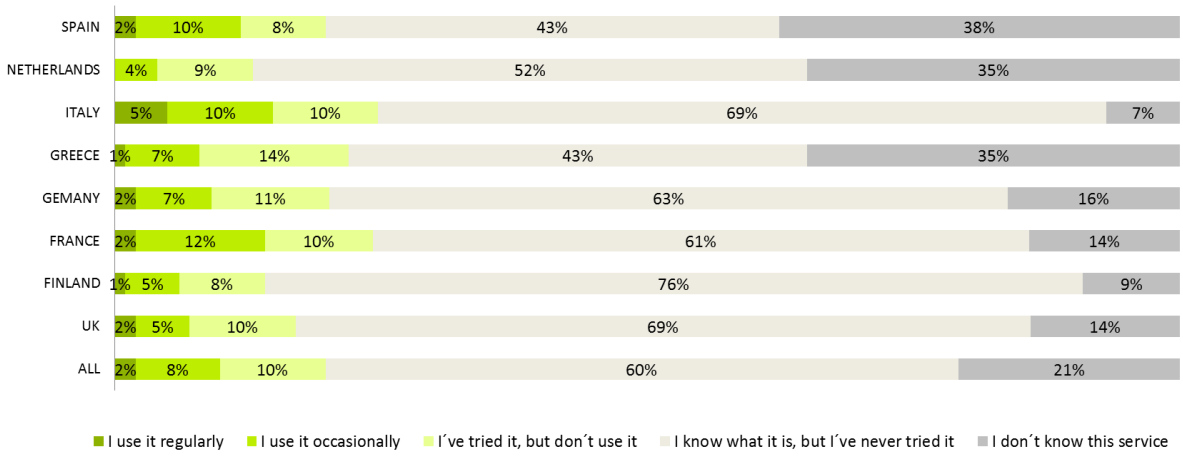
Taxi services are used occasionally especially in the UK and Finland, followed by Spain and Greece. Around one third of the respondents in the Netherlands, Italy and Germany stated that they use taxi also occasionally. Interestingly, France, Italy and Germany have the highest proportion of people who did know the service but have never used it.




Unlike taxi services, car-sharing services have only become available relatively recently and mostly only in larger cities. Thus, it is not surprising that a rather small proportion of the respondents in all countries use the service regularly or occasionally. The share of people that have tried it, but don´t use it on a regular basis in all countries is in the same range (between 8 % in Finland and up to 14 %

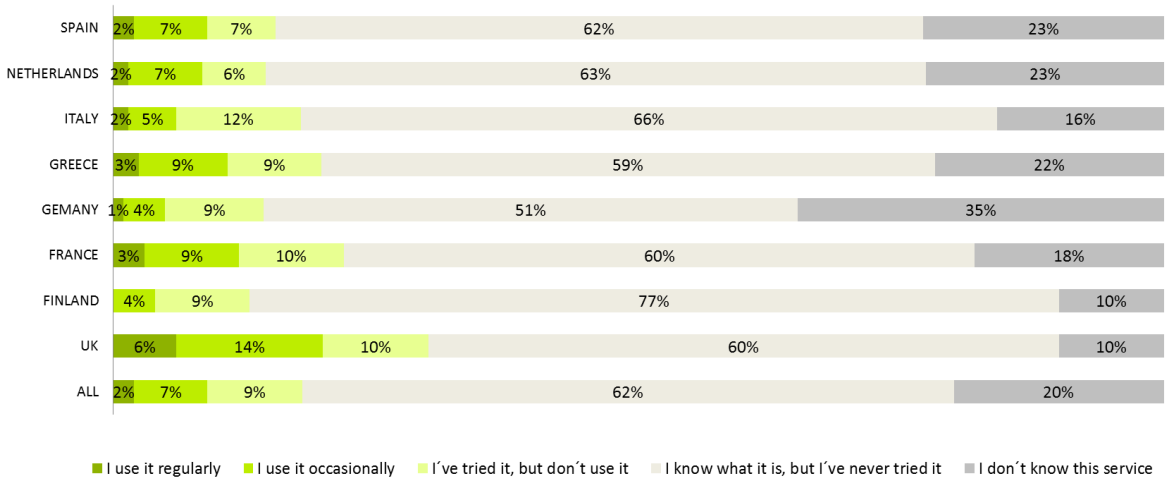
in Greece). The share of people that know the service, but have never tried it, is highest in Finland, Italy and the UK, followed by Germany and France. In Spain, the Netherlands and Greece, between 35 % and 38 % of the respondents stated that they don´t know this service, which is the highest share among all countries.

**Which of the following best describes your experience with the following services? - Carsharing service**




Considering respondents´ experience and use of the mobility service UBER shows a similar picture as when considering the experience with car-sharing services – the majority of the respondents know the service but have never tried it. The highest share of persons that use the service regularly or at least occasionally is in the UK, followed by France and Greece. Note that the service is not available in many parts of the addressed countries and in some of them it is also not legally allowed, for instance in Germany. Hence, it is not surprising that Germany has the highest share of people who stated that they don´t know the service, followed by Spain, the Netherlands and Greece.

**Which of the following best describes your experience with the following services? - UBER**



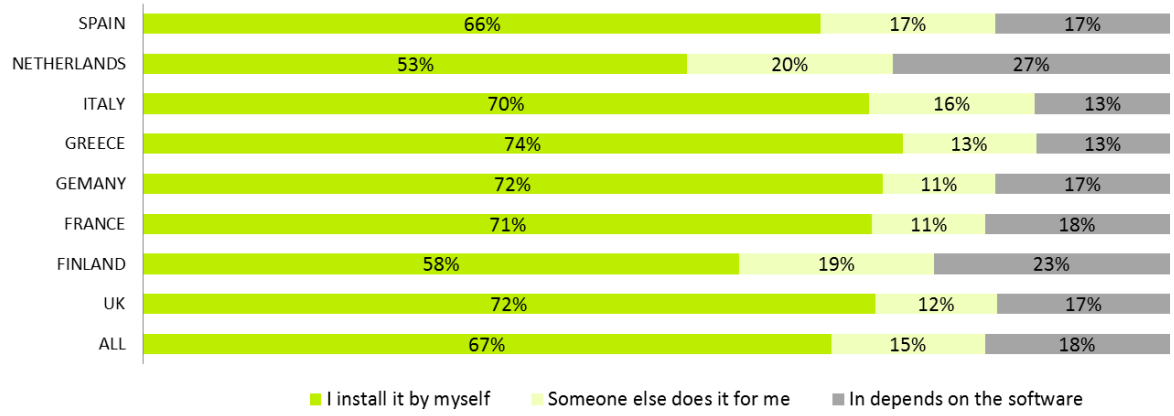

### 10.2.3 IT experience and familiarity with the topic IoT

The IT experience and technology/ software affinity were addressed using a question on whether the respondents install new software by themselves or not. As it was an online survey, we decided not

to ask about their internet usage as we assume that persons who are part of an online panel or who are recruited via online social media have overall high affinity to computer and internet usage.

The results show that the majority of the respondents (67 %) install new software by themselves. The share is lower in the Netherlands and Finland with consequentially higher share of respondents stated that it depends on the software. All other countries have similar share of persons who stated that they install new software by themselves (ranging from 66 % in Spain up to 74 % in Greece).

**Question 22 - Do you install new software yourself, or do you have someone else to do it for you?**

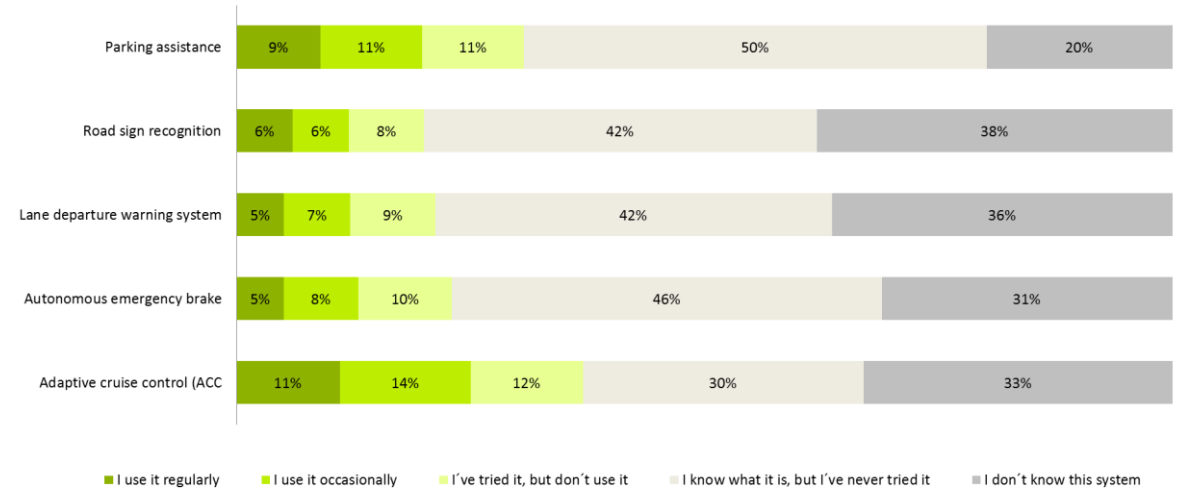



When asked how familiar they are with the topic Internet of Things (IoT), one third of all respondents (33 %) state that they are not familiar with the topic at all. Comparing the countries shows that (almost) half of the respondents from Germany and Finland are not familiar with the topic at all. Note that the higher share of people in Germany who stated that they are not familiar with the topic at all can be also attributed to the fact that the term “Internet of Things” was used in the survey in Germany only as English term (no translation of the term was presented to the respondents). This will be considered for all countries in the surveys on scenario B and C. Most familiar with the topic are the respondents in France, Greece, and Italy, followed by the UK, Finland, Netherlands and Spain.

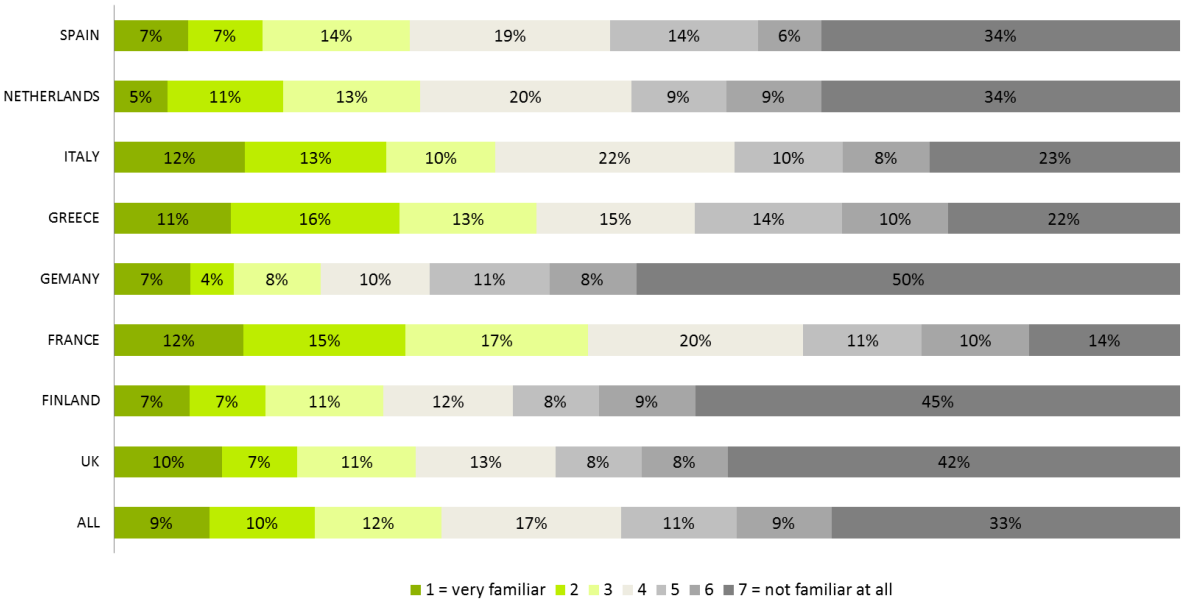
**Experience with advanced driver assistance systems (ADAS)**

The respondents were also asked to report their experience with different advanced driver assistance systems. The results are shown for the whole sample and not differentiated by country. The results show that adaptive cruise control (ACC) is the assistance system that the most respondents have experience with compared to the other systems (37 % have at least tried it), followed by the parking assistance (31 % have tried). The other systems (road sign recognition, lane departure warning system and autonomous emergency brake) are used by about the same proportion of respondents (20–23 % have tried). This is not surprising considering the fact that these systems are available primarily in new vehicle models and in higher class cars. Road sign recognition and lane departure warning system were also the items that have the highest proportion / numbers of the answer “don´t know”.

**Which describes best your experience with the following advanced driver assistance systems?**
**ALL (n=1611)**

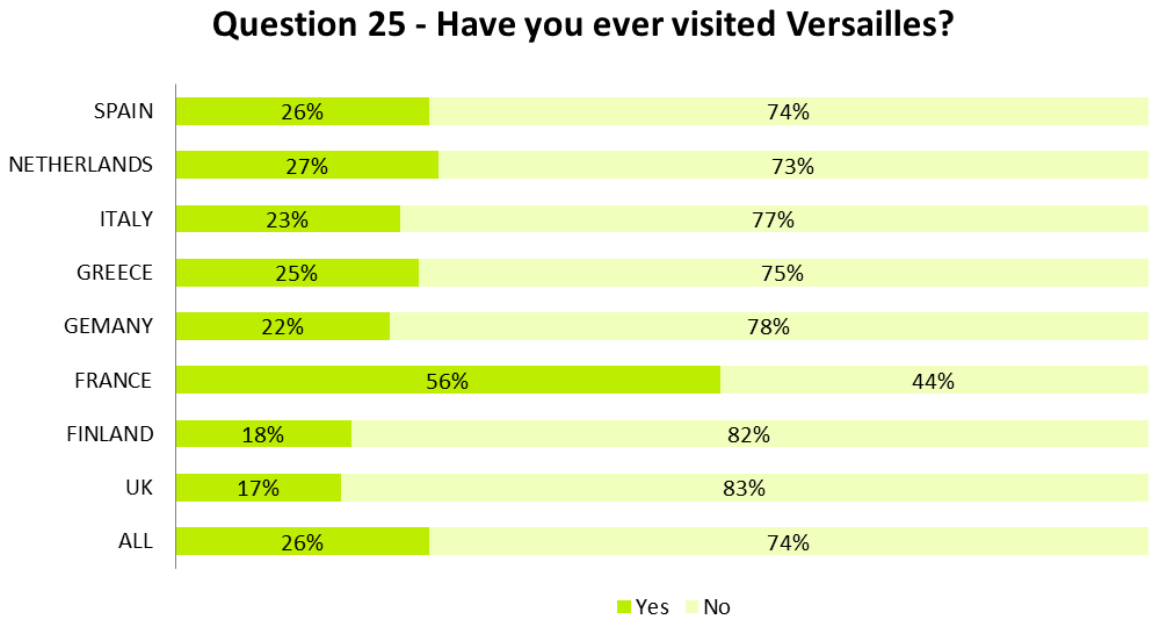



**Question 23: How familiar are you with the topic Internet of Things (IoT)**



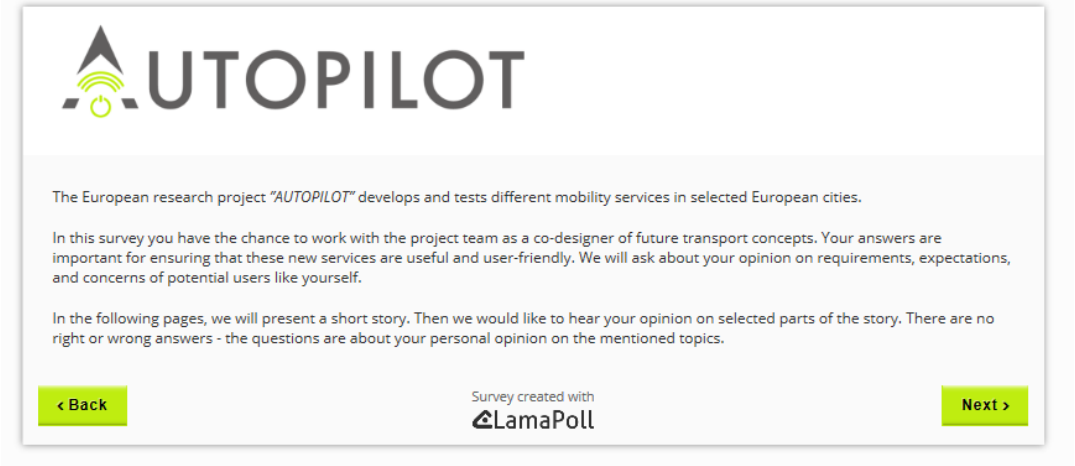
### 10.2.4 Other relevant experience

In scenario A the respondents were also asked whether they have been to Versailles. As expected, only in France a majority of respondents (56 %) have visited Versailles. In all other countries, respondents have less experience with the city – ranging from 17 % up to 27 % of the respondents stated that they have visited Versailles.



## 10.3 Screenshots of the online questionnaire – Scenario A (English version)

Page 1:

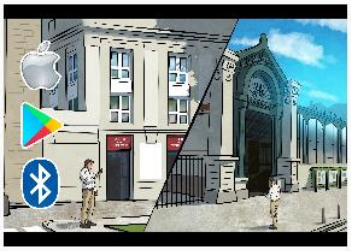



Page 2:


Page 3:

AUTOPILOT

John is a tourist who is visiting France on his holiday. Let´s see how the new touristic service works with the example of John´s trip to France.

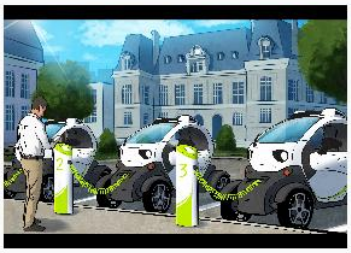


Today John is visiting Versailles. He has heard about the new service for tourists and has decided to try it out.

He downloads the app *"AUTOPILOT"*, chooses his language (English), and creates an account.

Using the app, John chooses one of the pick-up stations and reserves a vehicle.

The app shows him the route to the station where the reserved vehicle is waiting for him.



John arrives at the station. The app indicates the reserved vehicle's license plate number and parking lot number.

He unplugs the vehicle from the station and opens it using the app. He then gets into the vehicle.


John is now ready to start his trip.

**The service can provide different types of information to John via the app.**

**What do you think about the relevance of the following information?**

| | 1 = very relevant | 2 | 3 | 4 | 5 | 6 | 7 = irrelevant |
|---|---|---|---|---|---|---|---|
| Route guidance to the pick-up station | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Information about the availability of a vehicle | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Estimated waiting time in the case no vehicle is currently available | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The route of the tour | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Information about congestion on the planned route with the vehicle | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Which (personal) data are required for using the service | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Instructions for how to use the service | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Availability of a free spot at the return stations | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Contact information for customer service | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Tourist information (points of interest/ sights near John´s location) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Information about restaurants, hotels, cafes, etc. near John´s location | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Other information *(please specify or write "no")*: | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**John might have some concerns about using the service.**

**If you were in John´s position, to what extent would you be concerned about the following aspects?**

| | 1 = not at all concerned | 2 | 3 | 4 | 5 | 6 | 7 = very concerned |
|---|---|---|---|---|---|---|---|
| Data privacy (e.g. abuse of private data) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Cybersecurity (e.g. vulnerability to hacking/ exploitation) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Using the service will influence smartphone battery (e.g. it will decrease quickly because of the data volume used for the service) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The information provided by the service might be incorrect due to malfunction or data losses | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The payment for the service might be not secure | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Other concerns *(please specify or write "no")*: | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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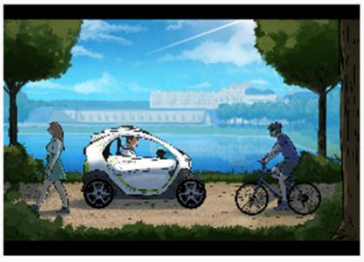
Page 4:

AUTOPILOT


John wants to visit the Versailles Gardens, so he selects the destination on the *"AUTOPILOT"* app.

The app helps him navigate and John drives the vehicle to the entrance of the Gardens. From here, the self-driving mode is activated and the vehicle takes over the driving task.

There is no motorised traffic in the Gardens, but the self-driving vehicle is allowed to drive on the paths along with pedestrians and cyclists.



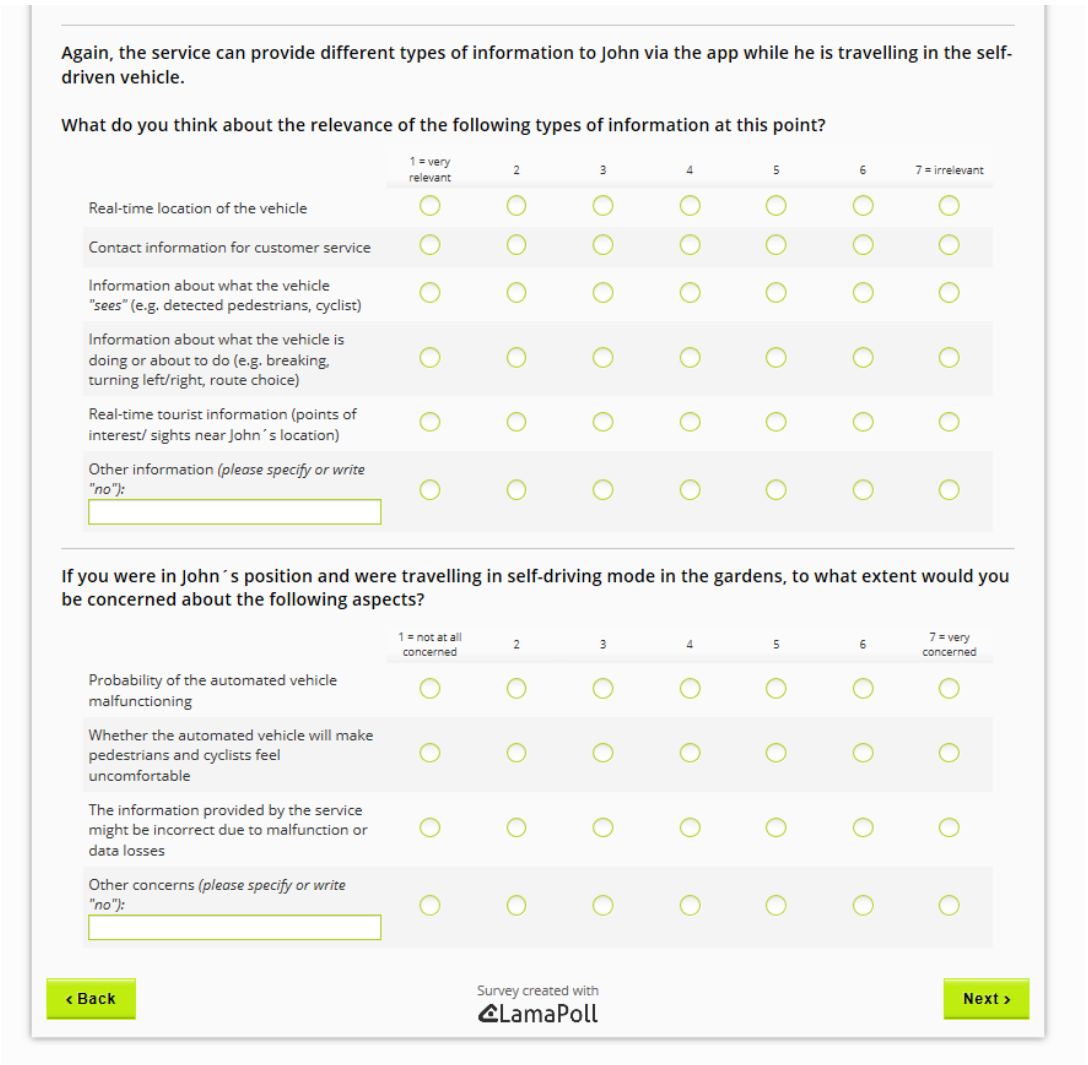
The route through the Gardens is fixed, about 2 km long and with the vehicle travelling at around 15 km/h it takes roughly 20 minutes.

The vehicle is self-driving, so John does not have to worry about taking the wheel and can admire the Gardens in peace. Using its sensors and cameras, the car gives way to pedestrians and cyclists.

The vehicle arrives near a point of interest.


A notification shows up on screen and a voice message says: *"We are in front of the Lake of the Swiss Guard. Would you like to know more about it?"*

John says *"Yes"*. Now the vehicle stops and he can choose whether he wants to listen to an audio message or to watch a short video (about 1 minute) about this point of interest.



**Again, the service can provide different types of information to John via the app while he is travelling in the self-driven vehicle.**

**What do you think about the relevance of the following types of information at this point?**

| | 1 = very relevant | 2 | 3 | 4 | 5 | 6 | 7 = irrelevant |
|---|---|---|---|---|---|---|---|
| Real-time location of the vehicle | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Contact information for customer service | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Information about what the vehicle *"sees"* (e.g. detected pedestrians, cyclist) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Information about what the vehicle is doing or about to do (e.g. breaking, turning left/right, route choice) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Real-time tourist information (points of interest/ sights near John´s location) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Other information *(please specify or write "no"):* | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**If you were in John´s position and were travelling in self-driving mode in the gardens, to what extent would you be concerned about the following aspects?**

| | 1 = not at all concerned | 2 | 3 | 4 | 5 | 6 | 7 = very concerned |
|---|---|---|---|---|---|---|---|
| Probability of the automated vehicle malfunctioning | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Whether the automated vehicle will make pedestrians and cyclists feel uncomfortable | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The information provided by the service might be incorrect due to malfunction or data losses | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Other concerns *(please specify or write "no"):* | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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Page 5:

AUTOPILOT

The automated vehicle continues along the route, passing other points of interest in a similar way, until it reaches the exit of the Gardens, at which point the self-driving mode ends.

John starts driving again and the AUTOPILOT app guides him to the vehicle drop-off station. John parks the vehicle and leaves.

After returning the vehicle, a trip summary is displayed on the app (duration and distance of the trip). John can now rate his experience.

---

To conclude, we would like to ask you to evaluate the whole scenario from booking to the end of the trip.

**How would you evaluate the described scenario if you were in John´s position?**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| a positive experience | ○ | ○ | ○ | ○ | ○ | ○ | ○ | a negative experience |
| exciting | ○ | ○ | ○ | ○ | ○ | ○ | ○ | boring |
| useful | ○ | ○ | ○ | ○ | ○ | ○ | ○ | useless |
| safe | ○ | ○ | ○ | ○ | ○ | ○ | ○ | dangerous |
| easy to use | ○ | ○ | ○ | ○ | ○ | ○ | ○ | complicated |

**To what extent do you agree or disagree with the following statement?**

| | 1 = strongly agree | 2 | 3 | 4 | 5 | 6 | 7 = strongly disagree |
|---|---|---|---|---|---|---|---|
| I would use the service if it was available. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**To what extent do you agree or disagree with the following statements?**

**I would prefer using the self-driving vehicle if it was available ...**

| | 1 = strongly agree | 2 | 3 | 4 | 5 | 6 | 7 = strongly disagree |
|---|---|---|---|---|---|---|---|
| ... more than walking or cycling in the Gardens. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| ... more than walking or cycling in the city. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| ... more than renting a car in the city. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| ... more than using a tourist bus in the city. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**If you were in John´s position, which data or data access would you be willing to share with the service provider in order to be able to use the service?**

*Please check all that apply.*

- ☐ Name, Surname
- ☐ Nickname instead of Name, Surname
- ☐ E-Mail Address
- ☐ Register with an existing account: Facebook, Google, etc.
- ☐ Driving license number
- ☐ Payment data (e.g. bank account, credit card)
- ☐ Other payment options (e.g. PayPal)
- ☐ Access to GPS on the smartphone
- ☐ Access to microphone on the smartphone
- ☐ Activation of Bluetooth on the smartphone
- ☐ Other *(please specify):*

**In this scenario, the app works only for this service in Versailles. In the future, it could be expanded to cover other services and cities. For which other services would you like to use the app?**

- ☐ for booking and using other mobility services in Versailles (e.g. public transport, car rental, bike rental, tourist bus)
- ☐ for going on a sightseeing tour without using a vehicle as well
- ☐ for a similar service in other cities
- ☐ for other services *(please specify):*
- ☐ no other services, I would use it only in Versailles for this tour and service

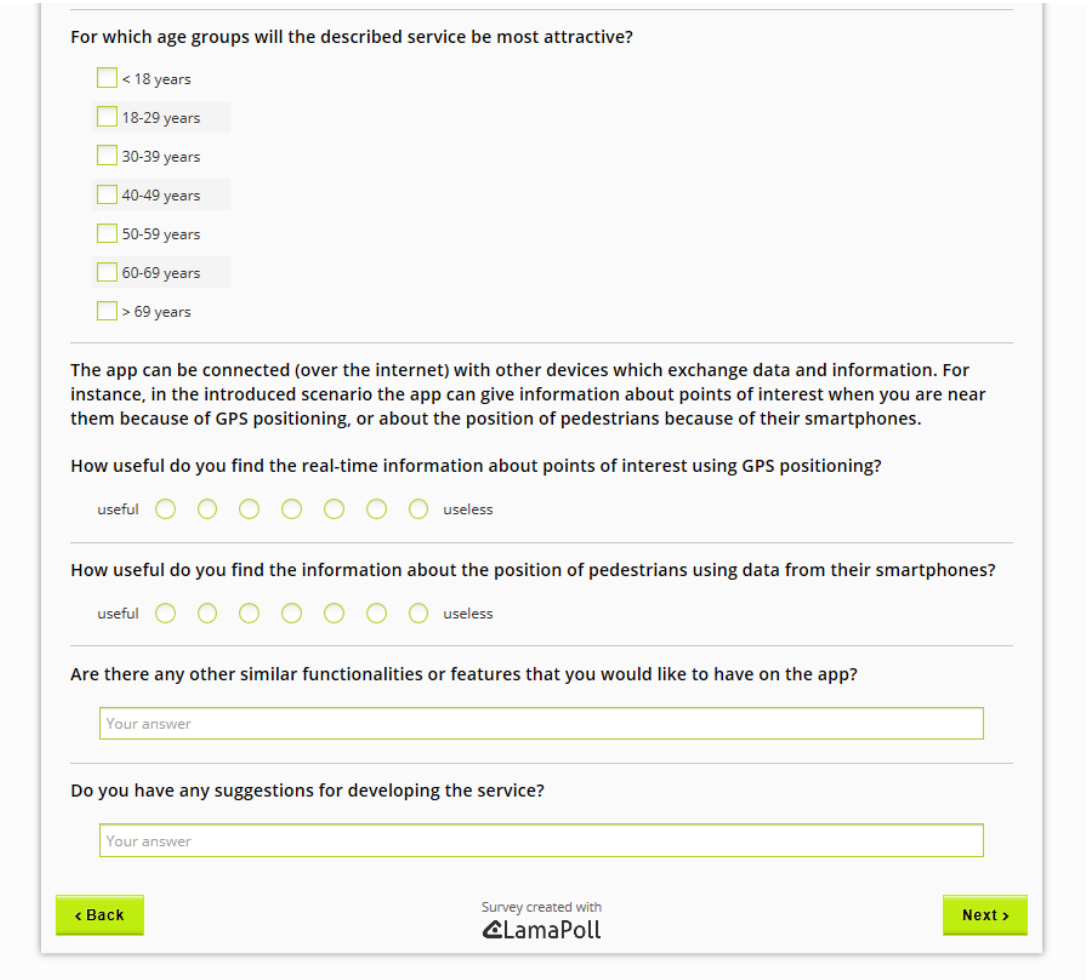
**What do you think would be the most convinient pricing basis fot the system?**

- ○ Cost per minutes when using the vehicle
- ○ Fixed price for a tour
- ○ Included in a package "Tour in Versailles" comprised of other mobility and touristic services

**For which people will the described service be most attractive?**

*Please note that the service can include also other vehicle types and sizes than the introduced one.*

- ☐ Individuals (tourists travelling alone)
- ☐ Couples (tourists travelling in a couple)
- ☐ Families (tourists travelling with children)
- ☐ People with mobility constrains (e.g. disabilities, age-related constrains)
- ☐ Other *(please specify):*



For which age groups will the described service be most attractive?

- [ ] < 18 years
- [ ] 18-29 years
- [ ] 30-39 years
- [ ] 40-49 years
- [ ] 50-59 years
- [ ] 60-69 years
- [ ] > 69 years

The app can be connected (over the internet) with other devices which exchange data and information. For instance, in the introduced scenario the app can give information about points of interest when you are near them because of GPS positioning, or about the position of pedestrians because of their smartphones.

How useful do you find the real-time information about points of interest using GPS positioning?

useful ○ ○ ○ ○ ○ ○ ○ useless

How useful do you find the information about the position of pedestrians using data from their smartphones?

useful ○ ○ ○ ○ ○ ○ ○ useless

Are there any other similar functionalities or features that you would like to have on the app?

Your answer

Do you have any suggestions for developing the service?

Your answer

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Page 6:

AUTOPILOT

At the end of the survey, we would like to ask you some questions about yourself.

**How often do you use the following modes of transportation?**

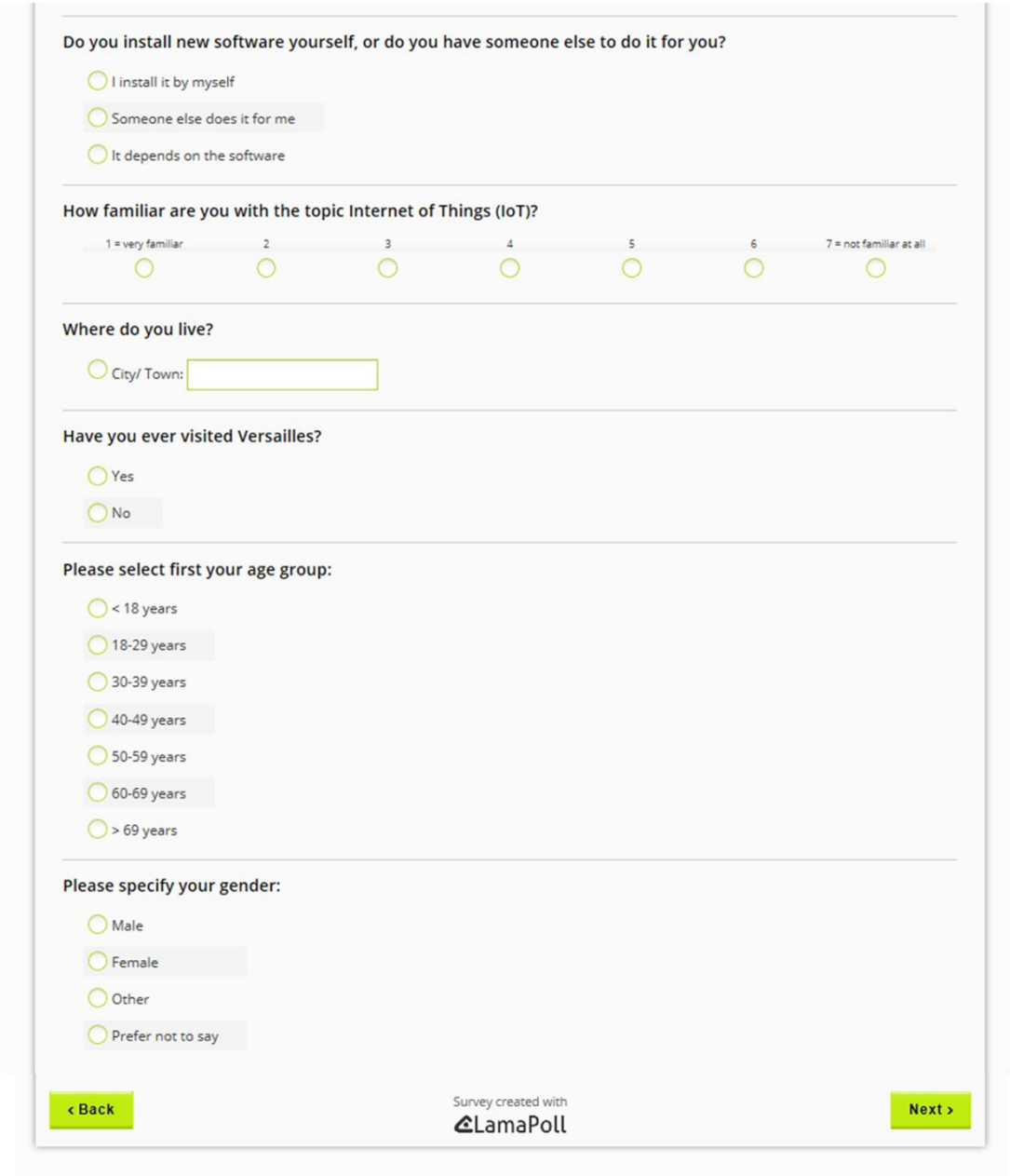
| | daily | weekly (1 to 6 times a week) | monthly (1 to 3 times a month) | less than monthly | (almost) never |
|---|---|---|---|---|---|
| Walk (>500m) | ○ | ○ | ○ | ○ | ○ |
| Bicycle | ○ | ○ | ○ | ○ | ○ |
| Private car | ○ | ○ | ○ | ○ | ○ |
| Public transport | ○ | ○ | ○ | ○ | ○ |
| Motorbike/ moped | ○ | ○ | ○ | ○ | ○ |

**Which describes best your experience with the following advanced driver-assistance systems?**

| | I use it regularly | I use it occasionaly | I´ve tried it, but don´t use it | I know what it is, but I´ve never tried it | I don´t know this system |
|---|---|---|---|---|---|
| Adaptive cruise control (ACC) | ○ | ○ | ○ | ○ | ○ |
| Autonomous emergency brake | ○ | ○ | ○ | ○ | ○ |
| Lane departure warning system | ○ | ○ | ○ | ○ | ○ |
| Road sign recognition | ○ | ○ | ○ | ○ | ○ |
| Parking assistance | ○ | ○ | ○ | ○ | ○ |

**Which of the following best describes your experience with the following services?**

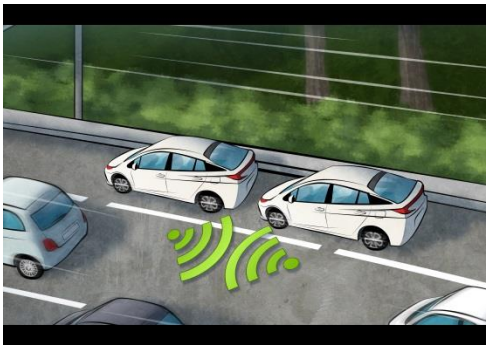
| | I use it regularly | I use it occasionally | I´ve tried it, but don´t use it | I know what it is, but I´ve never tried it | I don´t know this service |
|---|---|---|---|---|---|
| Taxi service | ○ | ○ | ○ | ○ | ○ |
| Carsharing services | ○ | ○ | ○ | ○ | ○ |
| UBER | ○ | ○ | ○ | ○ | ○ |
| Other mobility services *(please specify or write "no")* | ○ | ○ | ○ | ○ | ○ |




## 10.4 Full questionnaires – Scenario B and Scenario C (English version)

**Scenario B**

Helmond is a city in the Netherlands, located about 15 km from Eindhoven. To travel from Helmond to Eindhoven by car can take between 20 and 60 minutes depending on the traffic situation on the highway.



A new service has been introduced in Helmond, offering people with the same destination to drive together in a so-called “platoon”.

A platoon is a formation of cars travelling together as a group at a close distance to each other – one car leads the group and the other cars follow it.

The cars in the platoon have to have special equipment which enables them to communicate with each other. In our case, the leading car is driven manually, while the following cars drive in self-driving mode.

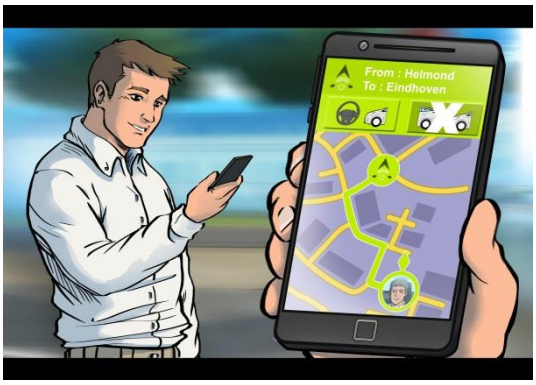

The platooning is available in this case only on the highway. Cars, which drive in a platoon, can use a priority lane on the highway, which can reduce their journey time.

The cars connect into a platoon prior to entering the highway and stay connected throughout the duration of the highway journey.

The new service uses the smartphone app “AUTOPILOT” which enables users to enter their routes and find other people with the same itineraries. Users can choose either to create a new platoon and lead the other cars or to join an existing one.

**Scene 1**

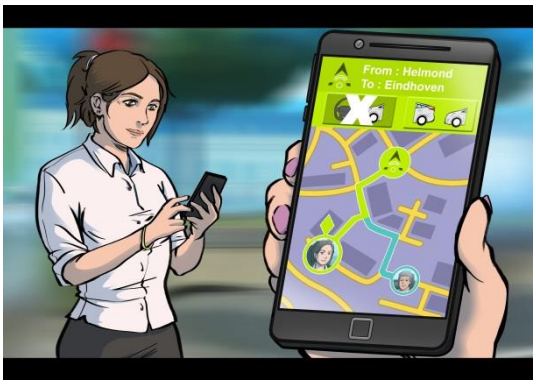
Bart and Wendy both live and work in Helmond. Let´s see how the service works with an example of a trip they are both taking to Eindhoven.




Today, Bart needs to drive from Helmond to Eindhoven for an appointment.

He has heard about the new service and decides to try it out so he can use the priority lane on the highway. He enters his destination into the "AUTOPILOT" app and enables the option for platooning.

The service searches for other user(s) with a similar route who want to join the platoon.




Wendy also needs to go to Eindhoven to meet a client. She checks on her "AUTOPILOT" app if someone else is looking for platooning too, and receives the option to join Bart´s platoon.

She confirms the match with Bart and chooses a location on her route where they can meet for the platoon formation.

**The service can provide different types of information to Wendy and Bart via the app.**
**How relevant do you think the following information is for Wendy and Bart when considering using the service?**

| | 1 = very relevant | 2 | 3 | 4 = neutral | 5 | 6 | 7 = irrelevant |
|---|---|---|---|---|---|---|---|
| Cost savings when using platooning for this trip instead of driving their cars without platooning | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Estimated travel time | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Emission savings when platooning for this trip instead of driving their cars without platooning | | | | | | | |
| Other options for reaching their destination (e.g. using another transport mode) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Which (personal) data are required for using the service | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| How many other people are using the platoon | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Current traffic situation on the highway | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other platooning options available | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other information *(please specify or write "no")* _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**The service can also provide Wendy with information about Bart.**

**How relevant do you think the following information is for Wendy when considering using the service?**

| | 1 = very relevant | 2 | 3 | 4 = neutral | 5 | 6 | 7 = irrelevant |
|---|---|---|---|---|---|---|---|
| Real-time location of Bart's car | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Bart's contact details (e.g. phone number) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Information about Bart's previous platooning appointments (e.g. number of previous appointments as leader and follower, routes and destinations, rating from other users) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Information about Bart's car (e.g. age, car model, plate number) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Any special needs that other users may have | | | | | | | |
| Other information *(please specify or write "no"):* _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Wendy and Bart might have some concerns about using the service.**
**If you were in their position, to what extent would you be concerned about the following aspects?**

| | 1 = not at all concerned | 2 | 3 | 4 = neutral | 5 | 6 | 7 = very concerned |
|---|---|---|---|---|---|---|---|
| Data privacy (e.g. abuse of private data) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Cyber security (e.g. the system can be hacked) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Using the service app will influence smartphone battery (e.g. it will get low faster because of the data volume used for the service) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| The information provided by the service might be incorrect due to malfunction or data loss | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Cost of using the service (both for data and for service provision) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | |
| The other person might not come to the appointment | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| The leader might not go to the agreed destination | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| The leader might not be a safe driver | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| The leader might not be the person they say they are | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Being able to stop the journey if you are not the leader | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| The connection between the vehicles might be lost | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other concerns *(please specify or write "no")*: _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Bart can have different reasons for using the platooning service.**
**How important do you think the following reasons are in choosing to use the service?**

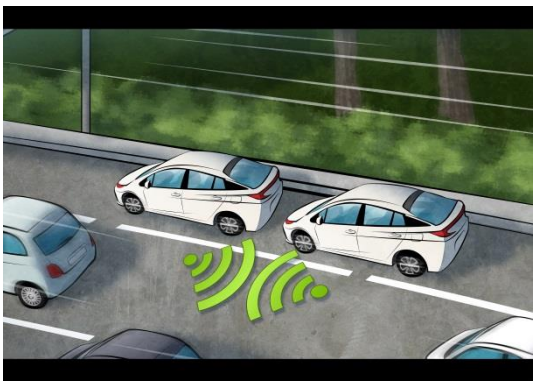
| | 1 = very important | 2 | 3 | 4 = neutral | 5 | 6 | 7 = very unimportant |
|---|---|---|---|---|---|---|---|
| The car can use the priority lane, so Bart can save time | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Bart can receive money if he leads a platoon | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Bart can receive other incentives, such as credits or free access to the service, if he leads a platoon | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other reasons *(please specify or write "no")*: _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Wendy can also have different reasons for using the platooning service.**
**How important do you think the following reasons are in choosing to use the service?**

| | 1 = very important | 2 | 3 | 4 = neutral | 5 | 6 | 7 = very unimportant |
|---|---|---|---|---|---|---|---|
| The car can use the priority lane, so Wendy can save time | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Wendy does not have to drive | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Wendy can do something else while riding in self-driving mode | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other reasons *(please specify)*: _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Scene 2**

Everything worked well with the platooning appointment. Bart and Wendy are travelling on the highway using the priority lane. Bart is driving the leading vehicle, while Wendy´s car is following in self-driving mode.



The cars in the platoon as well as the service users´ smartphones are constantly exchanging information with each other and with elements of the infrastructure, such as traffic lights, the traffic management centre or the weather station.

To achieve this, the cars need some equipment, such as internet access. This allows the cars for example to communicate about how to form the platoon and warn each other in case of unexpected events.

Wendy´s and Bart´s cars both have this equipment. Also, their smartphones are connected with the car communication system. Hence, the information which is received via the app "AUTOPILOT" is also shown on a display in the car and vice versa.


In our story, Bart has just received a message from the traffic management centre on the "AUTOPILOT" app as well as on a display in his car warning him that an accident just happened on his route. A recommendation for him to drive more slowly shows up on the screen of his smartphone via the app, and he responds accordingly.

**In this example, Bart receives real-time information about an accident on the route. Also other types of information could be provided to Bart via a display in the car and the app.**
**How relevant do you think the following information is to Bart's journey?**

| | 1 = very relevant | 2 | 3 | 4 = neutral | 5 | 6 | 7 = irrelevant |
|---|---|---|---|---|---|---|---|
| Real-time information about accidents on the route *(such as in the example)* | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Real-time information about congestion on the route | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Information about hazards on the road (e.g. potholes) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Information about road works on the route | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Suggestions for alternative routes | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Real-time information about the weather (e.g. forecast for rain) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Real-time information about the status of the platoon (e.g. the connection between the vehicles, headway between the vehicles, etc.) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Concerns or other communications from other users in the platoon | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Strength and security of data connection (to service, to different other services, to users) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other information *(please specify or write "no"):* _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**In this example, Bart receives a recommendation via the app to reduce speed.**
**How relevant do you think the following recommendations that can be provided by the service are to Bart's journey?**

| | 1 = very relevant | 2 | 3 | 4 = neutral | 5 | 6 | 7 = irrelevant |
|---|---|---|---|---|---|---|---|
| Recommendation on speed, based on an upcoming hazard*(such as in the example)* | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Alternate and/or faster route(s) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Headway between the vehicles in | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| the platoon | | | | | | | |
| Moving out of the priority lane (e.g. due to an upcoming hazard or congestion) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other recommendations *(please specify or write "no"):* _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**If you were in Bart´s position and were driving on the highway, to what extent would you be concerned about the following aspects?**

| | 1 = not at all concerned | 2 | 3 | 4 = neutral | 5 | 6 | 7 = very concerned |
|---|---|---|---|---|---|---|---|
| Data privacy (e.g. abuse of private data) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Cyber security (e.g. the system can be hacked) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| The information provided by the service (including connection to other cars) might be incorrect due to malfunction or data loss | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Responsibility/liability for the safety of the following car(s) as a leader of the platoon | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Technical failure of a following car | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| The user of a following car might choose to detach from platoon | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | |
| Other concerns *(please specify or write "no")*: _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Scene 3**

Bart is in the leading car of the platoon, so he drives manually. Wendy is in the car that follows Bart´s car, so her car drives in self-driving mode. Throughout the journey, Wendy can prepare for her meeting with her client.

Wendy's car has been warned by Bart's car that it is slowing down and adapts its speed automatically. Wendy does not have to take any action.

**Wendy can receive different types of information via the app or via a display in the car while riding in self-driving mode.**
**How relevant do you think the following information is to Wendy's journey?**

| | 1 = very relevant | 2 | 3 | 4 = neutral | 5 | 6 | 7= irrelevant |
|---|---|---|---|---|---|---|---|
| Information about what the leading car is doing or about to do (e.g. speed reduction) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Information on why the leading car is doing something (e.g. accidents, hazards) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Information about congestion on the route | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Information about what her car "sees" (e.g. other cars beside or behind the car) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Information about what her car is doing or about to do (e.g. speed adaption, route choice) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Information about the status of the platoon (e.g. platooning with 1 meter headway) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Estimated time left in self-driving mode | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Strength and security of data connection to service and leading and other platooning cars | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other information *(please specify or write „no"):* _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**If you were in Wendy´s position and were travelling in self-driving mode on the highway, to what extent would you be concerned about the following aspects?**

| | 1 = not at all concerned | 2 | 3 | 4 = neutral | 5 | 6 | 7 = very concerned |
|---|---|---|---|---|---|---|---|
| Data privacy (e.g. abuse of private data) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Cyber security (e.g. the system can be hacked) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| The information provided by the service/by Bart´s car might be incorrect due to malfunction or data loss | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| The driver in the leading car (Bart) might have a bad driving style | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Safety of the self-driving mode | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Technical failure of the leading or other connected cars | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Being able to take back control of the car if she wants to | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Another user detaching from the platoon (especially if between her and Bart) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other information *(please specify or write "no"):* _____ | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**There are different options to ensure that Wendy feels comfortable using the self-driving mode when driving in a platoon.**
**To what extent do you agree or disagree with the following statements?**

| | 1= strongly agree | 2 | 3 | 4 = neutral | 5 | 6 | 7 = strongly disagree |
|---|---|---|---|---|---|---|---|
| Information about Bart (e.g. positive rating from other users) will make Wendy feel more comfortable. | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| The service should suggest Wendy to take back the control of her vehicle in unsafe circumstances. | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Wendy should have anytime the option to take back the control of her car if she wants to. | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Scenario B**

Wendy and Bart safely reach Eindhoven and leave the highway.

As platooning is only available on the highway, from here the platooning ends. Wendy resumes control of her car and both Bart and Wendy drive independently.

Then, Wendy and Bart drive to their final destinations. Because they used the service, which allowed them to drive efficiently and use the priority lane, they reached their destination quicker and at lower cost and emissions than if they travelled independently.

To conclude, we would like to ask you to evaluate the whole scenario from the platooning appointment to the end of the trip.

**How would you evaluate the described scenario if you were in Bart´s position?**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| a positive experience | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | a negative experience |
| exciting | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | boring |
| useful | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | useless |
| safe | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | dangerous |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| easy to use | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | complicated to use |

**How would you evaluate the described scenario if you were in Wendy´s position?**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| a positive experience | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | a negative experience |
| exciting | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | boring |
| useful | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | useless |
| safe | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | dangerous |
| easy to use | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | complicated to use |

**If you had a self-driving and connected car, to what extent do you agree or disagree with the following statements?**

| | 1= strongly agree | 2 | 3 | 4 = neutral | 5 | 6 | 7 = strongly disagree |
|---|---|---|---|---|---|---|---|
| I would like to use the platooning service <u>as a platoon leader</u> if it was available. | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| I would like to use the platooning service <u>as a follower</u> if it was available. | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**To what extent do you agree or disagree with the following statements?**
**I would prefer using the service for my trip if it was available …**

| | 1= strongly agree | 2 | 3 | 4 = neutral | 5 | 6 | 7 = strongly disagree |
|---|---|---|---|---|---|---|---|
| ... over driving in a conventional (not connected and self-driving) car | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| ... over using public transport. | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| … over using a car-sharing service | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**If you were in Wendy's or Bart's position, which data or data access would you be willing to share with the service provider to be able to use the service?**
*Please check all that apply*

[ ] Name, Surname
[ ] Nickname instead of Name, Surname
[ ] E-Mail Address
[ ] Register with an existing account: Facebook, Google, etc.
[ ] Driving license number
[ ] Payment data (e.g. bank account, credit card)
[ ] Other payment options (e.g. PayPal)
[ ] Access to GPS on the smartphone
[ ] Access to microphone on the smartphone
[ ] Other *(please specify)*: _____

**For which trip purposes do you think the described service would be most attractive?**
[ ] Commuting to work
[ ] Driving to a business appointment
[ ] Driving to a private appointment
[ ] Other trip purpose *(please specify)*: _____

**For which age groups will the described service be the most attractive?**
[ ] < 18 years
[ ] 18-24 years
[ ] 25-39 years
[ ] 40-59 years
[ ] 60-79 years
[ ] > 80 years
[ ] equally all
[ ] don't know

**The app and the car can be connected (over the internet) with other devices exchanging data and information. For instance, in the introduced scenario the app can give real-time information about an accident on the road sent from other vehicles ahead or the traffic management center.**

**How useful do you find this feature?**
**1 = useful --- 4 = neutral --- 7 = useless**

**Are there any other similar functions that you would like to have if you use the app?**
[ ] _____

**Do you have any suggestions how to develop the service?**
[ ] _____

**Scenario B**
At the end of the survey, we would like to ask you some questions about yourself.
**How often do you use the following modes of transportation?**

| | (almost) daily | weekly (1 to 4 times a week) | monthly (1 to 3 times a month) | less than monthly | (almost) never |
|---|---|---|---|---|---|
| Walk (> 500 m) | [ ] | [ ] | [ ] | [ ] | [ ] |
| Bicycle | [ ] | [ ] | [ ] | [ ] | [ ] |
| Private car | [ ] | [ ] | [ ] | [ ] | [ ] |
| Motorbike/ moped | [ ] | [ ] | [ ] | [ ] | [ ] |
| Public transport | [ ] | [ ] | [ ] | [ ] | [ ] |

**Which of the following best describes your experience with the following advanced driver-assistance systems?**

| | I use it regularly | I use it occasionally | I´ve tried it, but don´t use it | I know what it is, but I´ve never tried it | I don´t know this system |
|---|---|---|---|---|---|
| Adaptive cruise control (ACC) | [ ] | [ ] | [ ] | [ ] | [ ] |
| Autonomous emergency brake | [ ] | [ ] | [ ] | [ ] | [ ] |
| Lane departure warning system | [ ] | [ ] | [ ] | [ ] | [ ] |
| Road sign recognition | [ ] | [ ] | [ ] | [ ] | [ ] |
| Parking assistance | [ ] | [ ] | [ ] | [ ] | [ ] |

**Which describes best your experience with the following services?**

| | I use it regularly | I use it occasionally | I´ve tried it, but don´t use it | I know what it is, but I´ve never tried it | I don´t know this service |
|---|---|---|---|---|---|
| Taxi service | [ ] | [ ] | [ ] | [ ] | [ ] |
| Carsharing services | [ ] | [ ] | [ ] | [ ] | [ ] |
| Ridesharing services | [ ] | [ ] | [ ] | [ ] | [ ] |

| | | | | | |
|---|---|---|---|---|---|
| UBER | [ ] | [ ] | [ ] | [ ] | [ ] |
| Other mobility services *(please specify or write "no")*: _____ | [ ] | [ ] | [ ] | [ ] | [ ] |

**How familiar are you with the topic Internet of Things (IoT)?**

| 1 = very familiar | 2 | 3 = neutral | 4 | 5 = not familiar at all |
|---|---|---|---|---|
| [ ] | [ ] | [ ] | [ ] | [ ] |

**Where do you live?**
[ ] City/Town: _____

**Please select your age group**
[ ] < 18 years
[ ] 18-24 years
[ ] 25-39 years
[ ] 40-59 years
[ ] 60-79 years
[ ] > 80 years

**Please specify your gender**
[ ] Male
[ ] Female
[ ] Other
[ ] Prefer not to say

The European research project *"AUTOPILOT"* develops and tests different mobility services in selected European cities.

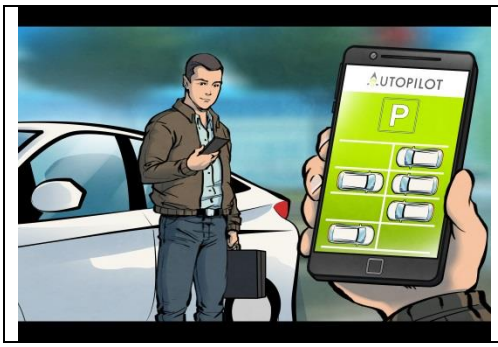
In this survey you have the chance to work with the project team as a co-designer of future transport concepts. Your answers are important for ensuring that these new services are useful and user-friendly. We will ask about your opinion on requirements, expectations, and concerns of potential users like yourself.

In the following pages, we will present a short story. Then we would like to hear your opinion on selected parts of the story. There are no right or wrong answers - the questions are about your personal opinion on the mentioned topics.

**age - Please select your age group**
[ ] < 18 years
[ ] 18-24 years
[ ] 25-39 years
[ ] 40-59 years
[ ] 60-79 years
[ ] > 80 years

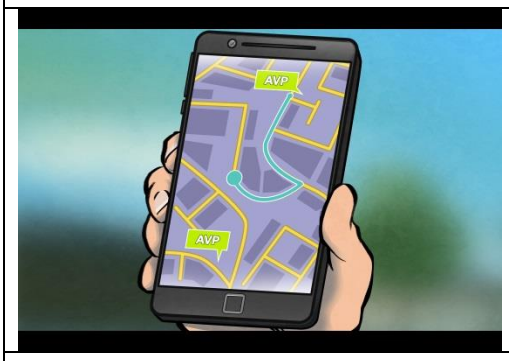
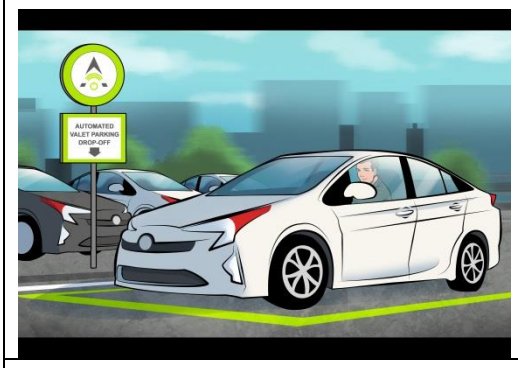
**gender - Please specify your gender**
[ ] Male
[ ] Female

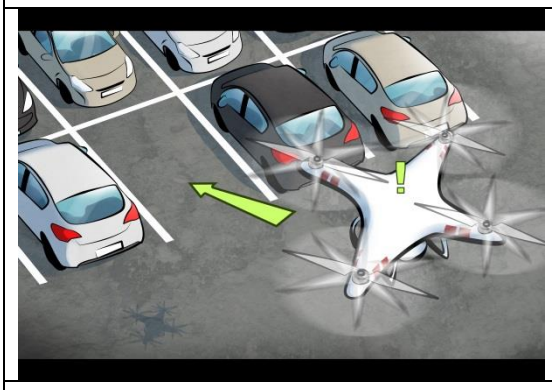
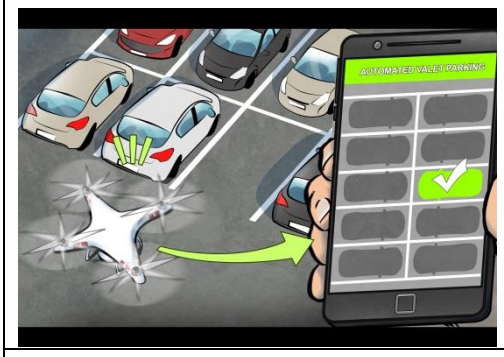
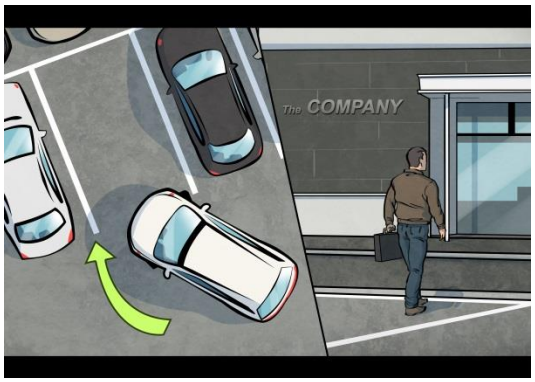
**<u>Scenario C: Automated valet parking</u>**

| | |
|---|---|
|  | A new parking service has been introduced in several places in the city of Helmond in the Netherlands, allowing people to access an automated valet parking.<br><br>Using the service, one can drive to a drop-off station in front of a building where the service is available (such as a shopping center or company building), get out of the car and the car can park by itself within a designated parking lot. |

**Scenario C – Scene 1**

Bob lives and works in Helmond. Let´s see how the service works with the example of Bob´s first experience with it.

| | |
|---|---|
|  | Bob has heard about the new parking service and wants to try it. Today Bob has a business appointment at a company in Helmond where the new service is available, so this is his chance to try it out. He has already downloaded the app "AUTOPILOT" which enables him to use the service. |
|  | Bob drives to his destination and stops at a drop-off station in front of the company´s building at the Automotive campus where his appointment is. |
|  | He gets out of the car and sends a request for automated valet parking using his app. The app connects to the parking management system to check for a free parking spot in the campus parking lot. |

| | |
|---|---|
|  | Today is a very busy day at the Automotive campus because of a large congress. The parking management system checks the current status of the parking spots using the dedicated cameras in the parking lot and finds that all spots visible for the cameras are reported as “occupied”.<br><br>The parking management system seeks the assistance of drones that are employed to support automated valet parking, as the management system estimates that there are still parking spots available. At the request of the parking management system, the drone starts searching for a free parking spot. |
|  | The drone sets off its flight and finds some free parking spots that were not clearly visible to the dedicated cameras and informs this to the parking management service. |
|  | The parking management system now assigns a free parking spot to Bob’s car and sends Bob this information. Bob accepts the suggested parking spot and sends his car to park using the app. |
|  | Bob doesn’t have to take care of the parking and goes to his appointment. His car drives automatically to the dedicated parking spot to park by itself.<br><br>The car usually takes the shortest route to the parking lot. But today the access road to the parking lot is blocked by a truck of the waste management system of the city trying to empty the waste containers.<br><br>The parking management system provides an alternative obstacle free route to Bob’s car. Bob’s car takes this route and drives in automated mode into the parking spot. |

**Q1 - The service can provide different types of information to Bob via the app.**
**What do you think about the relevance of the following information?**

| | 1 = very relevant | 2 | 3 | 4 = neutral | 5 | 6 | 7 = irrelevant |
|---|---|---|---|---|---|---|---|
| **Q1.A1 -**Location where the service is available on a city map | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q1.A2 -**Availability of a free parking spot | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q1.A3 -**Real-time location of the car while it is parking | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q1.A4 -**Location of the free parking spot | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q1.A5 -**Parking status of the car (e.g. it is parked now) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q1.A6 -**Contact inforamation for a customer service | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

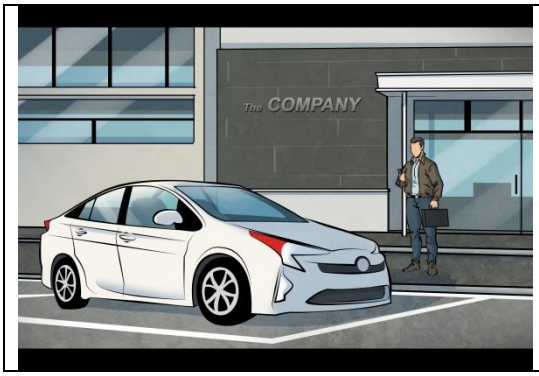
**Q1_other -**Other information (please specify): _____

**Q2 - Bob might have some concerns about using the service.**
**If you were in Bob´s position, to what extent would you be concerned about the following aspects?**

| | 1 = not at all concerned | 2 | 3 | 4 = neutral | 5 | 6 | 7 = extremely concerned |
|---|---|---|---|---|---|---|---|
| **Q2.A1 -**Data privacy (e.g. abuse of private data) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q2.A2 -** Cybersecurity (e.g. vulnerability to hacking/ exploitation) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q2.A3 -** The automated system of the car might not work reliably | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q2.A4 -** Information might be incorrect due to malfunction or data loss | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Q2_other -** Other concerns (please specify): _____

**<u>Scenario C – Scene 2</u>**




At the end of his meeting, Bob uses his smartphone and the "AUTOPILOT" app again to retrieve his car. The car drives automatically from the parking lot to the pickup point.

**Q3 - Also now, the service can provide via the app different types of information to Bob.**

**What do you think about the relevance of the following information?**

| | 1 = very relevant | 2 | 3 | 4 = neutral | 5 | 6 | 7= irrelevant |
|---|---|---|---|---|---|---|---|
| **Q3.A1 -** Real-time location of the car | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q3.A2 -** Information what the car "sees" (e.g. detected pedestrians) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q3.A3 -** Information about what the car is doing or about to do (e.g. turning left/right, breaking) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q3.A4 -** Contact information for customer service | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Q3_other-** Other information (please specify): _____

**Q4 - Bob might have some concerns also while waiting for the car to pick him up.**
**If you were in Bob´s position, how concerned would you be about the following aspects?**

| | 1 = not at all concerned | 2 | 3 | 4 = neutral | 5 | 6 | 7 = very concerned |
|---|---|---|---|---|---|---|---|
| **Q4.A1 -** Data privacy (e.g. abuse of private data) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q4.A2 -** Cyber security (e.g. the system can be hacked) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q4.A3-** The automated system might not work reliably | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q4.A4 -** Information might be incorrect due to malfunction or data loses | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Q4_other-** Other concerns (please specify): _____

**<u>Scenario C – General scenario questions</u>**

To conclude, we would like to ask you to evaluate the whole scenario from booking the automated valet parking to picking up Bob after the meeting.

**Q5 - How would you evaluate the described scenario if you were in Bob´s position?**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Q5-1** a positive experience | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | a negative experience |
| **Q5-2** exciting | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | boring |
| **Q5-3** useful | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | useless |
| **Q5-4** safe | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | dangerous |
| **Q5-5** easy to use | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | complicated to use |

**Q6 To what extent do you agree or disagree with the following statement?**

| | 1 = strongly agree | 2 | 3 | 4 = neutral | 5 | 6 | 7 = strongly disagree |
|---|---|---|---|---|---|---|---|
| **Q6** I would use the service if it was available. | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Q7 - To what extent do you agree or disagree with the following statements?**
**I would prefer using the automated valet parking if it was available …**

| | 1 = strongly agree | 2 | 3 | 4 = neutral | 5 | 6 | 7 = strongly disagree |
|---|---|---|---|---|---|---|---|
| **Q7-1**... over parking by myself. | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q7-2**... over conventional valet parking (another person is parking your car as a service). | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

**Q8 - If you were in Bob´s position, which data or data access would you be willing to share with the service provider to be able to use the service?**
*Please check all that apply*
[ ] **Q8_1** Name, Surname
[ ] **Q8_2** Nickname instead of Name, Surname
[ ] **Q8_3** E-Mail Address
[ ] **Q8_4** Register with an existing account: Facebook, Google, etc.
[ ] **Q8_5** Driving license number
[ ] **Q8_6** Payment data (e.g. bank account, credit card)
[ ] **Q8_7** Other payment options (e.g. PayPal)
[ ] **Q8_8** Access to GPS on the smartphone
[ ] **Q8_9** Access to microphone on the smartphone
[ ] **Q8_10** Activation of Bluetooth on the smartphone
[ ] **Q8_other** Other (please specify): _____

**Q9 - Which places do you find most attractive for implementing the automated valet parking?**
*You can choose more than one option*
[ ] **Q9_1** Shopping center
[ ] **Q9_2** Company building
[ ] **Q9_3** Cinema, Theater, Museum, etc.
[ ] **Q9_4** Housing: apartment buildings
[ ] **Q9_5** Housing: detached homes
[ ] **Q9_other** Other (please specify): _____

**Q10 - For which age groups will the described service be most attractive?**
[ ] **Q10_1** <18 years
[ ] **Q10_2** 18-24 years
[ ] **Q10_3** 25-39 years
[ ] **Q10_4** 40-59 years
[ ] **Q10_5** 60-79 years
[ ] **Q10_6** >80 years
[ ] **Q10_7** equally all
[ ] **Q10_8** don´t know

**Q11 - The app can be connected (over the internet) with other devices exchanging data and information. For instance, in the introduced scenario the app can give information about a free parking spot (because of the camera and the drone) or to send real-time information about the location of the car (because of the equipment in the car).**
**How useful do you find these features?**
**1 = useful --- 7 = useless**

**Q12 - Are there any other similar features that you would like to have if you used the app?**

[ ] _____

**Q13 - Do you have any suggestions how to develop the service to make it more useful for you?**

[ ] _____

**Scenario C – General questions**

At the end of the survey, we would like to ask you some questions about yourself.

**Q14 - How often do you use the following modes of transportation?**

| | (almost) daily | weekly (1 to 5 times a week) | monthly (1 to 3 times a month) | less than monthly | (almost) never |
|---|---|---|---|---|---|
| **Q14_1** Walk (> 500 m) | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q14_2** Bicycle | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q14_3** Private car | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q14_4** Motorbike/ moped | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q14_5** Public transport | [ ] | [ ] | [ ] | [ ] | [ ] |

**Q15 - Which describes best your experience with the following advanced driver-assistance systems?**

| | I use it regularly | I use it occasionally | I´ve tried it, but don´t use it | I know what it is, but I´ve never tried it | I don´t know this system |
|---|---|---|---|---|---|
| **Q15_1** Adaptive cruise control (ACC) | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q15_2** Autonomous emergency brake | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q15_3** Lane departure warning system | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q15_4** Road sign recognition | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Q15_5** Parking assistance | [ ] | [ ] | [ ] | [ ] | [ ] |

**Q16 - Does finding a free parking space regularly pose problems on your daily trips?**

[ ] Yes
[ ] No

**Q17 - To what extent do you find parking stressful?**

| 1 = very stressful | 2 | 3 = neutral | 4 | 5 = not stressful at all |
|---|---|---|---|---|
| [ ] | [ ] | [ ] | [ ] | [ ] |

**Q18- How familiar are you with the topic Internet of Things (IoT)?**

| 1 = very familiar | 2 | 3 = neutral | 4 | 5 = not familiar at all |
|---|---|---|---|---|
| [ ] | [ ] | [ ] | [ ] | [ ] |

**Q19 - Where do you live?**

[ ] City/Town: _____

## 10.5 Published articles and presentations

***ACCEPTED POSTER PRESENTATION:***

***Paper title:*** *"Assessing user expectations, requirements, and concerns toward automated driving progressed by internet of things – a user-centric development approach"*

***Conference:*** *8th Transport Research Arena TRA 2020, April 27-30, 2020, Helsinki, Finland*

# Assessing user expectations, requirements, and concerns toward automated driving progressed by internet of things – a user-centric development approach

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**Abstract**

Road vehicles are becoming increasingly automated and connected due to rapid technological progress and digitalization trends. Vehicle connectivity might improve automated driving (AD) in various ways. The EU project "AUTOPILOT" develops, tests and evaluates different services and use cases of AD focusing on the potential of Internet of Things (IoT) to progress AD. In order to provide early insights on expectations, requirements and concerns of potential users, an online survey was conducted. Three different scenarios of AD progressed by IoT were evaluated from user perspective. The results suggest that IoT can enable using the services with AD through easier trip planning by providing real-time traffic information. Second, IoT can accelerate the market deployment of AD services as trust in the system is increased by providing information about the vehicle operation. Third, IoT can contribute enhancing the user experience by providing real-time information about POIs and enabling customization options.

*Keywords:* automated driving, internet of things, connected driving, user acceptance

**1. Introduction**

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Rapid technological development and digitalization in almost all areas of daily life leads to ever increasing automation in transportation, including vehicle automation. The vehicle automation can be defined in five levels - from no automation (level 0), through low or partly automation (level 1 and 2), conditional automation (level 3) and high (level 4) to full (level 5) automation (SAE, 2018). While highly and fully automated driving can be achieved only relying on vehicle sensors, additional connectivity of the vehicle with its environment, i.e. converging sensor-based technologies and connected-vehicle communications, can progress the vehicle automation in various ways (e.g., KPMG, 2012). The main potential benefits of connectivity include accelerating and enhancing the technology of automated driving and its acceptance, and/or in some cases also enabling automated driving. Whilst there is already a body of literature about the user acceptance of autonomous driving and its drivers and barriers (see e.g. Fraedrich et al., 2016, Frison et al., 2018, Helgath et al., 2018, Payreet et al., 2014, Rödel et al., 2014), there is only little to no literature focusing on the impact of the Internet of Things (IoT) in automated cars on user acceptance (see e.g. Dominic et al., 2016 for a qualitative approach to understand the expectancies towards smart vehicles in an IoT context). Therefore, the focus of this research is on the added value of IoT in automated driving scenarios.

The research project "AUTOPILOT" (https://autopilot-project.eu/), funded by EU H2020 Research and Innovation programme, addresses the potential benefits of using Internet of Things (IoT) for automated driving (AD) by bringing together experts from the automotive as well as the information and communication technologies (ICT) world. Different use cases of AD progressed by IoT were developed by the project partners and tested at five pilot sites in Europe. The proposed use cases were evaluated from technology, business, user, society and legal perspectives. Understanding the user acceptance of the tested services is one important part of the evaluation and plays a crucial role for the future market penetration of the technology. Thus, analysing requirements, expectations and concerns of potential users is needed in order to evaluate the potential of the services and help us understand the users' mental models. Moreover, focussing on user expectations, requirements and concerns allows for user-centric development of the services and features ensuring that the technology serves the needs of the users.

The aim of the work presented in this paper is to assess the user acceptance of selected use cases of automated driving progressed by the use of IoT technologies by the general public. Since the services and functionalities tested in the project are in an early development phase, this study focuses on the preferences of potential users related to different anticipated features of the final products that make it useful and easy to use (two crucial determinants of user acceptance of technologies). Also, as the project focuses on the benefits of IoT for automated driving, the analyses look into how IoT enhance, enable and/ or accelerate AD.

## 2. Methodology

### 2.1. Overview of the empirical approach

As the services and features considered in the project were in an early development phase, the evaluation of the user acceptance in terms of willingness to use the technology followed a user-centric approach. Participation of users in the design process can take place at different levels including conducting surveys with potential users about their wishes and needs and letting users testing prototypes and giving feedback to the researchers (Friedhof, 2016). The approach of this project integrates those two main parts for the evaluation of the developed services – the first one is assessing user preferences of the general public in an online user survey and the second one is using the results as recommendations for developers and as input for pilot testing of the developed services with potential users within the "AUTOPILOT" projects. This paper focusses on the first phase – assessing

user preferences from surveying the general public.

Many studies on user acceptance in the context of automated and connected driving are based on theoretical approaches on acceptance of new technologies, such as the Technology Acceptance Model (TAM) developed by Davis (1985) and the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003).This survey is not directly based on this approach. However, it is in line with its main concepts, which suggest that user acceptance (in terms of willingness to use a service or function) is determined by evaluation of the usefulness and the ease of use of the technology. Following this approach, in the survey we identify functions or features of services that use IoT which are desirable for the users and which are the main concerns or acceptance barriers related to them. Thus, the assessment focusses on how services can be developed in a way to be perceived as useful and ease to use from a user perspective. In this sense, we have added an explorative pre-phase assessment of user acceptance determinants by addressing the expectations and requirements of potential users in the development stage of new services. Since the focus of the study is on the IoT part of services and IoT primary enables exchange of information and data, we explore deeper the requirements of the users on required information (e.g., real-time traffic or vehicle operation information) as well as concerns related to data exchange (e.g., data privacy or cyber security). Finally, we derived conclusions from the analyses about how will IoT enhance, enable or accelerate AD when considering user acceptance and user expectations, requirements, and concerns.

### 2.1. Considered use cases/ scenarios

Three scenarios were considered in the online survey for the general public. The selected use cases represent use cases of automated driving progressed by IoT that are developed and tested in the framework of the project “AUTOPILOT” and all rely on the user accessing the services through a mobile phone app. All use cases were presented to the respondents in short stories with pictures and short text description. The participants were led through the use case by describing briefly different phases of the usage of the service including booking of the service, using the service or during operation and finishing the use of the service. In this sense, we covered the full user experience addressing requirements and concerns on each stage of the user´ “journey” with additional overall evaluation of the service. Respondents were asked to report their requirements, concerns and evaluation of the service in each phase of the story by asking them to imagine being in the place of the main character of the story.

Scenario A “Carsharing as a touristic experience” considers a use case where tourists can use a new service in Versailles – they can rent a small vehicle using a smartphone application and use it in the city following a pre-defined route. In the Gardens of Versailles, tourists have the option to ride in the vehicle in automated mode and receive information about sights on the route. This scenario represents a use case where IoT functions enhance the user experience during automated driving by providing touristic information to the users. Additionally, IoT enables booking a vehicle, planning the route and reserving a parking spot at a return station.

Scenario B “Platooning” addresses a use case where users can drive together in a so-called “platoon” on a highway. A "platoon" is a formation of cars that drive as a group in close proximity to each other, with one manually driven car leading the group and the other cars following the leading car in self-driving mode. In addition to booking the service and matching the routes of the users, the IoT serves to connect the cars with each other as well as with the smart infrastructure, thus ensuring smooth communication between the leading car and the following cars. Platoon users can drive on a priority lane and reach their destination quicker and at lower cost and emissions than if they travel independently.

The use case presented in Scenario C “Automated Valet Parking” describes a new parking service where users can drive their car to a drop-off station, allowing their car to park autonomously in a free parking space. The IoT connects the parking management system with an app to provide the user with information on the availability and location of free parking spots. In addition, the IoT ensures that the self-driving car moves safely to the selected parking space and to the pick-up point when the user wants to retrieve it again via the app.

**2.3. Study set up and sample**

In order to assess requirements, expectations and concerns of different potential users, the online survey was conducted in eight countries: UK, Germany, France, Italy, Spain, Netherlands, Greece, and Finland. The countries were selected to represent different European countries as well as to cover the countries where the “AUTOPILOT” services are piloted. For the online implementation of the survey as well as for the recruiting of the study samples a professional service provider was used. The samples were selected to be representative for the population demographic in the selected countries by age and gender for the population between 18 and 69 years old. The sample size was n=200 persons per country for the first two scenarios (total n=1600 each) and n=100 for the third scenario (automated valet parking, total n=800).

The online questionnaire included detailed descriptions of the selected scenario and closed questions focussing on evaluation of single stages of the scenario. The scenario was presented in a storyboard format, using pictures and short text describing each scenario phase. In the scenarios, the story included three scenario parts – i) booking a vehicle/ service, ii) using the service (i.e., using the vehicle on a trip including an automated driving part), and iii) returning the booked vehicle or finishing the use of the service.

**2.4. Instruments and data analyses**

The questions used in the questionnaire were mostly closed questions where respondents were asked to evaluate different aspects on a seven-point Likert scale ranging from “very relevant” to “not relevant at all” for requirements regarding information provided by the service and “very concerned” to “not concerned at all” for concerns related to the booking or use of the service. The relevance of different types of information was considered as information which can be from the user perspective important, necessary, and interesting (or desirable) or a combination of these types of information. Additionally, questions related to the overall evaluation of the scenario as well as socio-economic factors were assessed. Descriptive analyses of the data were performed using the statistic software IBM SPSS (IBM Corp., 2011) and Excel. Selected results from these analyses regarding requirements, concerns and overall evaluation of the service from the user perspective are presented in the section that follows. The relationships between the assessed variables can provide additional insights into the data and will be considered in future work as this contribution focuses on descriptive statistics.

## 3. Results

The presented results are based on the analysis of data from the full sample and only in some part of the text selected results that indicate country specific differences are briefly mentioned. The questionnaire was developed in order to explore which features make the use case useful and easy to use. Identification of anomalous aspects would be an interesting finding.

**3.1. Scenario A: Carsharing as a touristic experience**

### 3.1.1. Requirements on information provided before and during the using the service

In the survey, the respondents were asked about the relevance of different types of information provided by the service in different phases of the use of service – before using the service (i.e., when booking the service) and during the usage (i.e., during operation). The results suggest that overall most of the respondents consider the presented information as relevant. There is some variation between the information types. Information most rated as “very relevant” includes the availability of a vehicle (53%), followed by instructions on how to use the service (49%). Less relevant than the mentioned aspects were estimated waiting time in case that no car is currently available, the route of the tour, availability of a free parking space when returning the vehicle, and contact information for a customer service. Information about restaurants, hotels and cafés was rated as least relevant from user point of view. When considering the information required during operation, i.e., using the vehicle in the Gardens, one finds that most of the potential users (66%) evaluate real-time tourist information as (very) relevant. This is not surprising considering the main purpose of the introduced service and indicates a positive assessment of this function. The other types of information that can be provided by the service during the usage phase are considered equally relevant.

The country specific analysis revealed rather small differences in the relevance of the provided information. Respondents from the UK, Greece, Finland and Italy seem to rate the information more relevant whereas respondents from the Netherlands tend to rate them slightly less relevant than the other countries.

Together, the results show that potential users attach high relevance to various kinds of information that supports them by planning their tour, improving the booking option, and making it easier to use the service. Moreover, one of the core features of the service - real-time touristic information - is evaluated as the most relevant information (of those questioned) from the user perspective, with nearly 70% of respondents rating it in the top two levels of relevance.

### 3.1.2. Concerns

Besides the relevance of different types of information, respondents were asked to what extent they would be concerned or not concerned about different aspects related to the booking and usage the service. The given options for potential concerns in the booking phase were all rated in a similar way, as expected. The option on which the most respondents chose “very concerned” was regarding the payment process for using the service. For all mentioned aspects (including cyber security, payment process, data privacy), less than 10% of the respondents reported that they were not at all concerned. A similar question regarding potential concerns of users was asked also for the phase during the operation of the vehicle, i.e., when using the service. This question was more limited than the first question, focussing on concerns related to safety aspects in the automated driving mode and impact on other road users. There is also very little difference in responses between the three aspects – probability of vehicle malfunction, making vulnerable users feel uncomfortable, and malfunction or loss of data affecting information - , suggesting relatively equal levels of concerns. Trends between countries showed that participants from the UK, Finland and Spain seemed to be most concerned, both before the operation and during the operation, whereas respondents from Italy and Greece appeared least concerned. In summary, more potential users expressed security concerns related to the payment for the service than any other aspects.

### 3.1.3. Overall assessment of the presented scenario from the user perspective

The overall assessment of the presented scenario was positive - the vast majority (>80%) of the

respondents evaluated the service described in the survey as a positive experience (i.e., scoring it between 1 and 3 on a seven point scale ranging from a positive experience to negative experience), which was perceived by over 75% (scores 1-3 on a seven point scale ranging from very exciting to very boring) of respondents as exciting, useful and easy to use. These aspects were all rated relatively equally, suggesting consistency of respondent answers. Although a lower number of respondents (66%) felt the service was safe (scoring 1-3), this was still over half of respondents. However, this finding suggested that challenging perceptions of safety may be a main barrier to user acceptance.

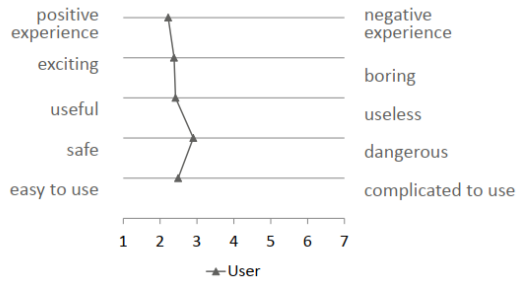



Fig. 1 Semantic differential of the overall assessment of Scenario A

### 3.2. Scenario B: Platooning

#### 3.2.1 Requirements on information provided before and during the using the service

In the survey, the participants were again asked about the relevance of different types of information supplied by the service at different stages of its use. The information prior to the use of the service that was judged to be (very) relevant by the majority of participants is information about the current traffic situation on the highway (60%) and the estimated travel time (59%) while information about emission savings when platooning (38%) and other options for reaching the destination were rated (very) relevant by fewer respondents. Overall, most of the presented information during operation seems to be more relevant to the respondents than those before using the service.

The questions were asked from the perspective of both – platoon leader and user sitting in the following car. For the platoon leader especially real-time information about accidents and congestions are considered (very) relevant (75% and 73%) as well as information about road works (69%) and suggestions for alternative routes (65%). In comparison to the above aspects, information about concerns or other communications from other users in the platoon and real-time information about the weather are rated (very) relevant by fewer participants, although it is still relevant for almost half of them. As one of the following cars in self-driving mode the information rated (very) relevant by the most participants are, generally speaking, information about the driving behavior of the leading car, thus why the leading car is doing something (66%) and what the leading car is doing or about to do (e.g. reduction) (65%). Information about what the self-driving car is doing or about to do and the estimated time left in self-driving mode are rated equally relevant.

The country specific analysis showed again that respondents from the Netherlands have a tendency to rate the required information less relevant than most of the other countries, while Greece and Germany tend to evaluate the presented information more relevant. It is noteworthy that especially the rating of “very relevant” is chosen less frequently by participants from the Netherlands.
In total, the results show that information during platooning have a high relevance to potential

users. In particular information on the driving behavior of the leading vehicle and the following cars in self-driving mode as well as events that might influence this behavior are highly relevant to the respondents. Information when considering the service is overall rated relevant by fewer people, but here as well information concerning the trip itself is the most relevant.

### 3.2.2. Concerns

The presented concerns relate to the use of the service and take into account the perspective of the platoon leader and the cars in self-driving mode. General concerns during operation refer to cyber security (44% (very) concerned) and data privacy (40% (very) concerned) as well as the unknown platoon leader. 44% of the respondents are (very) concerned, that the leader might not be a safe driver and 40% are (very) concerned, that the leader might not be the person they say they are. The least concerns relate to the effect of the platooning app on the smartphone battery (25% (very) concerned). In the platoon leaders perspective the responsibility for the safety of the following car(s) is most concerning (41% (very) concerned) followed by cyber security (40% (very) concerned) and technical failure of a following car (36% (very) concerned). From the perspective of a potential user in a self-driving car that follows the platoon leader 46% of the respondents claim to be (very) concerned about the safety of the self-driving mode, which is not necessarily an aspect that can only be attributed to the platooning use case, but probably refers to autonomous driving as such. Regarding the platooning service, participants are (very) concerned that the driver in the leading vehicle might have a bad driving style (44%). Cyber Security is for 41% of the respondents also a concerning aspect again.

Country differences regarding the concerns are rather small and most participants seem to have the same level of concerns, but participants from Italy seem to be less concerned than other countries. For example, for cyber security just a quarter of the Italian respondents, but almost half of the British respondents claim to be (very) concerned.

All together the main concerns are related to both the reliability of the system, including cyber security and the self-driving mode, as well as the driving behavior and identity of the platoon leader. In general, at least a quarter of the participants evaluate any aspect as alarming, showing that there are a lot of concerns that need to be addressed in the future.

### 3.2.3 Overall assessment of the presented scenario from the user perspective

The overall assessment of the platooning scenario was evaluated separately for the perspectives of the platoon leader and follower. The majority of the participants rated the scenario as a positive experience (77% from the follower's perspective scoring between 1 and 3 on a seven point scale ranging from a positive experience to negative experience and 78% from the platoon leader's perspective), whereas it was perceived as exciting, useful and easy to use for more than two thirds of the respondents. The biggest difference, though still rather small, between the two perspectives refers to the safety. 64% rated the scenario from the platoon leader's perspective as a safe experience in contrast to 60% from the follower's position. In general, the results indicate that the scenario is assessed slightly more positively from the perspective of the platoon leader. Even though most of the differences between both perspectives are statistically significant (e.g. for exciting vs. boring the score was lower, i.e. shifting more towards exciting, from the leader perspective ($M = 2{,}63$, $SD = 1{,}42$) than the follower perspective ($M = 2{,}69$, $SD = 1{,}31$), with $t = -2.25$, $p = .025$), the Cohens d effect sizes reveal only very small, negligible effects (e.g. exciting vs. boring, $d = .055$) with the biggest effect size for safe vs. dangerous ($d = .16$), which still has to be judged as small according to Cohen's conventions (Cohen, 1988). The small effect size can result, however, from a high variation within the full sample. Thus, in the next step, clustering the sample around smaller groups (e.g. extremes coupled together) might provide additional insights on potential differences. Once

again, the results suggest that the perception of safety might be a potential barrier to user acceptance of autonomous driving.

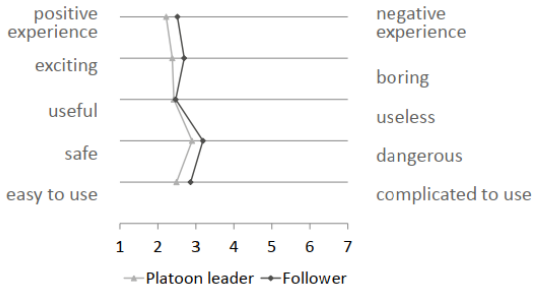



Fig. 2 Semantic differential of the overall assessment of Scenario B from the perspective of a platoon leader and a follower

### 3.3. Scenario C: Automated Valet Parking

#### 3.3.1 Requirements on information provided before and during the using the service

In Scenario C, the relevance of the required information for the situations during operation and when picking up the parked vehicle was assessed. The information rated (very) relevant during operation by most participants was the availability of a free parking spot (70%) followed by the location where the service is available on a city map (61%) as well as the (real-time) location of the car while it is parking and the free parking spot (58%). Least relevant, though still relevant for more than half of the respondents, is the parking status of the car (e.g. it is parked now). When picking up the parked vehicle the various presented information is judged as slightly less relevant than during operation. Most important is the information on real-time location of the car which is judged (very) relevant by 61% of the participants. Contact information for customer service is (very) relevant for half of the respondents while Information about what the car is doing or about to do (e.g. turning, braking) and what the car "sees" (e.g. detected pedestrians) is perceived as (very) relevant by less than half of the participants (42% and 44%).
With regard to the country-specific analysis, the picture is the same as before in the other scenarios; participants from the Netherlands seem to rate the information as somewhat less relevant than respondents from the other countries.

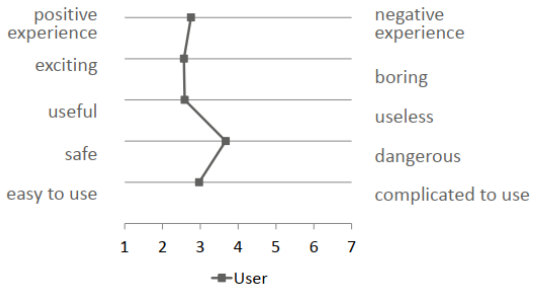
In summary, potential users demand information that enables the use of the service, such as the availability of the service and the availability of free parking spots as well as monitoring options during operation.

#### 3.3.2. Concerns

General concerns during operation refer to the reliability of the system, 43% are (very) concerned that the automated system of the car might not work reliably, and relate to cyber security, 39% of the respondents claim to be (very) concerned, e.g. about vulnerability to hacking. Data privacy is a concern for a quarter (26%) of respondents. While waiting for the car to drive to the pick-up station the concerns are rather similar and include the reliability of the automated system (44% (very) concerned), cyber security (37% (very) concerned) as well as incorrect information due to malfunction or data loss (39% (very) concerned) and data privacy (26% (very) concerned). Thus, the main concerns regardless of the situation are related to both the reliability of the vehicle technology and cyber security. Cyber security is for respondents from Italy and Greece less concerning than for the other respondents, but the reliability of the system concerns all respondents equally.

#### 3.3.3. Overall assessment of the presented scenario from the user perspective

The overall assessment of the automated valet parking scenario is positive. Over 70% evaluate the scenario as a positive experience (71% scoring between 1 and 3 on a seven point scale ranging from a positive experience to negative experience), as exciting (75% scoring between 1 and 3 on the scale ranging from exciting to boring) and useful (76% scoring between 1 and 3 on the scale ranging from a useful to useless). Furthermore, 63% of the respondents perceived the scenario as easy to use. It is




noteworthy that the safety aspect again receives the lowest approval, with only 44% of the participants rating this scenario as safe (scoring between 1 and 3 on the scale ranging from safe to dangerous).

Fig. 3 Semantic differential of the overall assessment of Scenario C

## 4. Discussion and conclusions

The survey presented in this paper aimed to assess potential user acceptance, in terms of usefulness and ease of use, of features and services based on automated and connected driving. For this purpose a an online survey was conducted where a concrete scenario is presented to potential users asking them about expectations, requirements and concerns regarding the service in different phases of the use (when booking the service, during operation and after usage). The main advantage to the proposed approach is that the results of the survey can be used in a user-centred development of functions and services, which potentially contribute to the user acceptance after introducing the final product to the market. In this paper, first results from the survey on one of overall three evaluated scenarios were presented. The analyses were focused around the question how IoT enhances, enables and accelerates AD.

Based on the results for the first scenario, some general recommendations for developing the services were derived. The results suggest that making the service easy to use and customizable plays an important role in ensuring user acceptance (i.e. willingness to use the service). In particular, coping with concerns related to the safety during the execution of the self-driving functions by providing sufficient information about what the vehicle is doing or about to do for instance, would be crucial. In all these aspects, the IoT will play a crucial role in enabling the provision of more detailed information in real time. Concerns related to payment security and malfunctions are important for both developers and service providers and users, as they can potentially affect users' trust in IoT systems' use during automated driving. Therefore, we concluded the following benefits of IoT for AD when considering user acceptance: first, IoT can enable using the services with AD through easier trip planning by providing real-time traffic system information. This aspect is related to the performance of the system. Second, IoT can accelerate the market deployment of AD services as trust in the system is increased by providing information about the vehicle operation – one aspect which is crucial for user acceptance of AD. This point can be considered as a base IoT-function for AD mainly because it increases the sense of control when driving automatically. Third, IoT can contribute enhancing the user experience by providing real-time information about POIs and enabling customization options. This aspect is rather an excitement than a performance factor which can be also crucial when considering using an AD-based service. All in one, all aspects – making the

service useful from user perspective, its performance understandable and reliable as well as enhancing the experience - have to be considered when developing new services. The weight, i.e., the importance, of the different factors on the decision for using the service, can be further explored in future research. Moreover, user tests allowing potential users to experience the service, as planned within the "AUTOPILOT" project, can additionally provide important insights on developing key features of the service and suitable human-machine-interaction.

**Acknowledgments**

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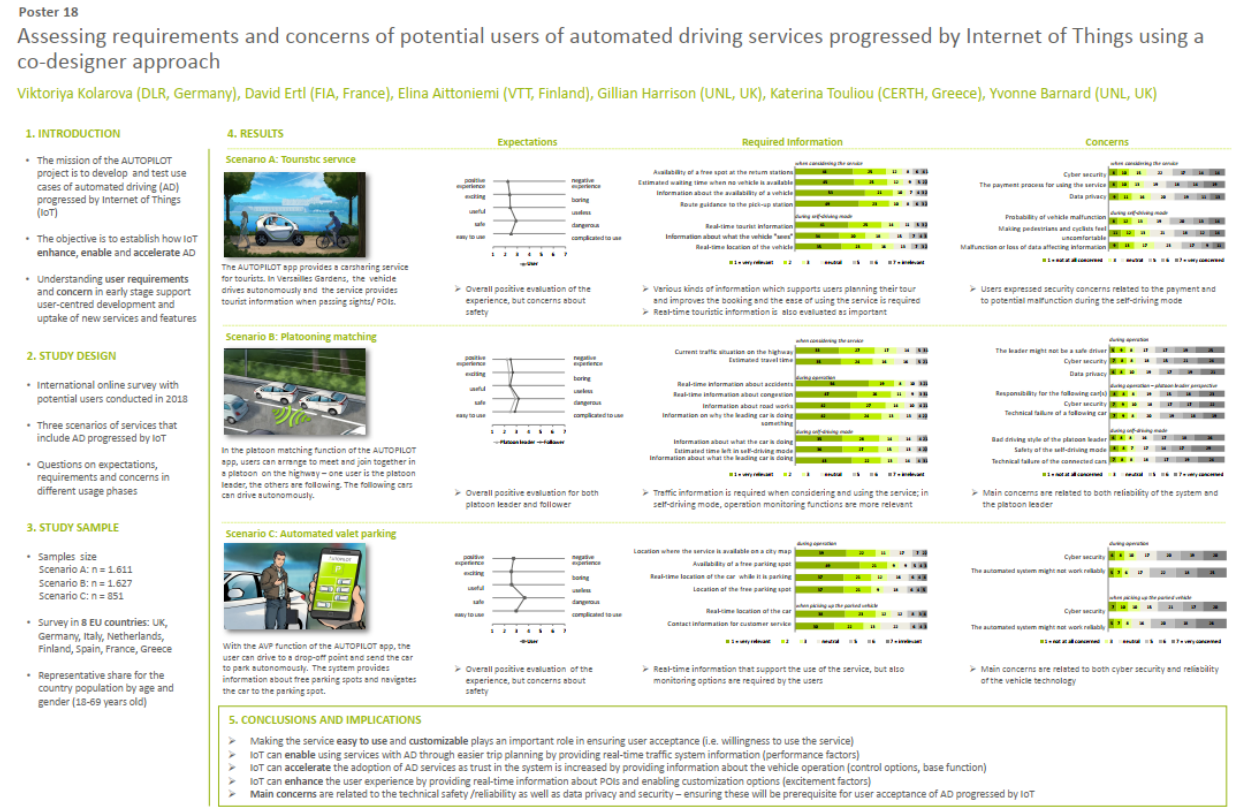
***ACCEPTED POSTER PRESENTATION:***

***Title:*** *"Assessing requirements and concerns of automated driving services progressed by Internet of Things using a co-designer approach"*

***Conference:*** *Automated vehicle symposium 2019, July 2019, Orlando, Florida, USA*



Poster 18

Assessing requirements and concerns of potential users of automated driving services progressed by Internet of Things using a co-designer approach

Viktoriya Kolarova (DLR, Germany), David Ertl (FIA, France), Elina Aittoniemi (VTT, Finland), Gillian Harrison (UNL, UK), Katerina Touliou (CERTH, Greece), Yvonne Barnard (UNL, UK)

1. INTRODUCTION

- The mission of the AUTOPILOT project is to develop and test use cases of automated driving (AD) progressed by Internet of Things (IoT)
- The objective is to establish how IoT **enhance, enable** and **accelerate** AD
- Understanding **user requirements** and **concern** in early stage support user-centred development and uptake of new services and features

2. STUDY DESIGN

- International online survey with potential users conducted in 2018
- Three scenarios of services that include AD progressed by IoT
- Questions on expectations, requirements and concerns in different usage phases

3. STUDY SAMPLE

- Samples size
  Scenario A: n = 1.611
  Scenario B: n = 1.627
  Scenario C: n = 851
- Survey in **8 EU countries**: UK, Germany, Italy, Netherlands, Finland, Spain, France, Greece
- Representative share for the country population by age and gender (18-69 years old)

4. RESULTS

Expectations | Required Information | Concerns

Scenario A: Touristic service

The AUTOPILOT app provides a carsharing service for tourists. In Versailles Gardens, the vehicle drives autonomously and the service provides tourist information when passing sights/ POIs.

- Overall positive evaluation of the experience, but concerns about safety
- Various kinds of information which supports users planning their tour and improves the booking and the ease of using the service is required
- Real-time touristic information is also evaluated as important
- Users expressed security concerns related to the payment and to potential malfunction during the self-driving mode

Scenario B: Platooning matching

In the platoon matching function of the AUTOPILOT app, users can arrange to meet and join together in a platoon on the highway – one user is the platoon leader, the others are following. The following cars can drive autonomously.

- Overall positive evaluation for both platoon leader and follower
- Traffic information is required when considering and using the service; in self-driving mode, operation monitoring functions are more relevant
- Main concerns are related to both reliability of the system and the platoon leader

Scenario C: Automated valet parking

With the AVP function of the AUTOPILOT app, the user can drive to a drop-off point and send the car to park autonomously. The system provides information about free parking spots and navigates the car to the parking spot.

- Overall positive evaluation of the experience, but concerns about safety
- Real-time information that support the use of the service, but also monitoring options are required by the users
- Main concerns are related to both cyber security and reliability of the vehicle technology

5. CONCLUSIONS AND IMPLICATIONS

- Making the service **easy to use** and **customizable** plays an important role in ensuring user acceptance (i.e. willingness to use the service)
- IoT can **enable** using services with AD through easier trip planning by providing real-time traffic system information (performance factors)
- IoT can **accelerate** the adoption of AD services as trust in the system is increased by providing information about the vehicle operation (control options, base function)
- IoT can **enhance** the user experience by providing real-time information about POIs and enabling customization options (excitement factors)
- **Main concerns** are related to the technical safety /reliability as well as data privacy and security – ensuring these will be prerequisite for user acceptance of AD progressed by IoT

The project has received funding from the European Union's Horizon 2020 Research and innovation programme under grant agreement No 731993

AUTOPILOT

Poster 18

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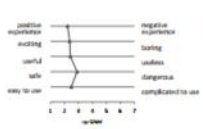


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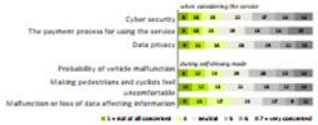


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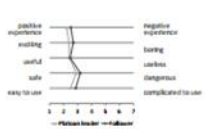


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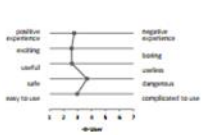


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