

Behavioural perspective on car owners' uptake of shared e-mobility: Car owners' motives for, and barriers to, trying out a vehicle from a Smart Shared Green Mobility Hub

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Summary

In the Interreg Smart Shared Green Mobility Hubs project, electric shared mobility is offered through eHUBs in the city. eHUBs are physical places in neighbourhoods where shared mobility is offered, with the intention of changing citizens' travel behaviour by creating attractive alternatives to private car use.

In this research, we aimed to gain insight into psychological factors that influence car owners' intentions to try out shared electric vehicles from an eHUB in order to ascertain:

1. The psychological factors that determine whether car owners are willing to try out shared electric modalities in the eHUBs and whether these factors are identical for cities with different mobility contexts.
2. How these insights into psychological determinants can be applied to entice car owners to try out shared electric modalities in the eHUBs.

Research was conducted in two cities: Amsterdam (the Netherlands) and Leuven (Belgium). An online survey was distributed to car owners in both cities in September 2020 and, additionally, interviews were held with 12 car owners in each city.

In general, car owners from Amsterdam and Leuven seem positive about the prospect of having eHUBs in their cities. However, they show less interest in using the eHUBs themselves, as they are satisfied with their private car, which suits their mobility needs. Car owners mentioned the following reasons for not being interested in trying out the eHUBs: they simply do not see a need to do so, the costs involved with usage, the need to plan ahead, the expected hassle with registration and 'figuring out how it works', having other travel needs, safety concerns, having to travel a distance to get to the vehicle, and a preference for ownership. Car owners who indicated that they felt neutral, or that they were likely to try out an eHUB, mentioned the following reasons for doing so: curiosity, attractive pricing, convenience, not owning a vehicle like those offered in an eHUB, environmental concerns, availability nearby, and necessity when their own vehicle is unavailable.

In both cities, the most important predictor determining car owners' intention to try out an eHUB is the perceived usefulness of trying out an eHUB. In Amsterdam, experience with shared mobility and familiarity with the concept were the second and third factors determining car owners' interest in trying out shared mobility. In Leuven, pro-environmental

attitude was the second factor determining car owners' openness to trying out the eHUBs, and age was the third factor, with older car owners being less likely to try one out.

Having established that perceived usefulness was the most important determinant for car owners to try out shared electric vehicles from an eHUB, we conducted additional research, which showed that, in both cities, three factors contribute to perceived usefulness, in order of relevance: (1) injunctive norms (e.g., perceiving that society views trying out eHUBs as correct behaviour); (2) trust in shared electric mobility as a solution to problems in the city (e.g., expecting private car owners' uptake of eHUBs to contribute to cleaner air, reduce traffic jams in city, and combat climate change); and (3) trust in the quality and safety of the vehicles, including the protection of users' privacy. In Amsterdam specifically, two additional factors contributed to perceived usefulness of eHUBs: drivers' confidence in their capacity to try out an unfamiliar vehicle from the eHUB and experience of travelling in various modes of transport.

Drawing on the relevant literature, the results of our research, and our behavioural expertise, we make the following recommendations to increase car users' uptake of shared e-mobility:

1. Address car owners' attentional bias, which filters out messages on alternative transport modes.
2. Emphasise benefits of (trying out) shared mobility from different perspectives so that multiple goals can be addressed.
3. Change the environment and the infrastructure, as infrastructure determines choice of transport.
4. For Leuven specifically: target younger car owners and car owners with high pro-environmental attitudes.
5. For Amsterdam specifically: provide information on eHUBs and opportunities for trying out eHUBs.

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1. Changing travel behaviour to reduce emissions

1.1 Shared electric mobility hub (eHUBs)

As cities are becoming more attractive places in which to live and work, with a consequent expected increase in housing, jobs, and population, cities anticipate an increase in mobility. However, their physical space is limited, and they are faced with the task of being accessible and clean (air), making the best possible use of public spaces, and ensuring that mobility is as emission-free as possible. Shared mobility, with electric vehicles, is a possible partial solution to this mobility challenge.

In the Interreg Smart Shared Green Mobility Hubs project, electric shared mobility is offered through eHUBs in a city. eHUBs are physical places, in neighbourhoods on the street, in (municipal) car parks, and in office car parks, where shared e-bikes, shared e-cargo bikes, shared e-scooters, and shared e-cars are offered. These e-modalities can be accessed via a smartphone. This project is being piloted in six European cities – Amsterdam and Nijmegen (The Netherlands), Manchester (UK), Leuven (Belgium), Kempten (Germany), and Dreux (France) – with the goal of investigating what is involved in eHUB implementation in cities. The focus in this pilot is on learning. By cities learning from one another and by doing, a blueprint will be developed for other cities that want to deploy eHUBs.

Shared e-modalities are cleaner than private cars that run on fossil fuel, take up less space (as they are shared by several households), and are an alternative to current private car journeys. The use of shared electric vehicles from the eHUBs should lead to more available (public) space, less car traffic, and lower CO₂ emissions. This is specifically the case when residents from high-density residential areas opt for eHUB vehicles, particularly e-bikes and e-cargo bikes, instead of their own private car. For this reason, and as we are interested in the transition from private car ownership to shared mobility, this research focuses on the target group of car owners.

eHUBs are intended to change citizens' travel behaviour by creating attractive alternatives to private car use, requiring a shift in citizens' travel behaviour. This is not easy to accomplish, as travelling is often automatic habitual behaviour, which is more difficult to change than behaviour based on deliberate conscious choice (e.g., e-bike purchase). Many different psychological mechanisms can be expected to hinder behavioural change when it comes to shifting from car ownership to shared mobility. As research partner in the project, the Psychology for Sustainable Cities research group from Amsterdam University of Applied Sciences conducts research to support the cities and providers with a behavioural perspective on eHUBs. In our research, we apply behavioural insights from the social psychological academic tradition to help tackle the challenge of reducing car use and car ownership in favour of shared mobility.

1.2 Aim of the research

In this research, we aimed to gain insight into psychological factors that influence car owners' intention to try out shared electric vehicles from an eHUB. Emphasis is thus placed on first use (or try out), as we theorise that first use is essential for becoming acquainted with shared electric mobility from an eHUB. This in turn is a first step towards car owners considering using shared electric mobility in their regular travel patterns. This research aimed to ascertain:

1. The psychological factors that determine whether car owners are willing to try out shared electric modalities in the eHUBs, and whether these factors are identical for cities with different mobility contexts.
2. How these insights into psychological determinants can be applied to entice car owners to try out shared electric modalities in the eHUBs.

1.3 Subsidy

The Smart Shared Green Mobility eHUBs project is subsidised by the Interreg North-West Europe subsidy programme, which is available for entities in European countries to work cooperatively on three topics: innovation, low carbon emissions, and resource and materials efficiency¹.

¹ <https://www.rvo.nl/subsidie-en-financieringswijzer/interreg-2014-2020/north-west-europe>

² In the communication with respondents in Belgium, eHUBs were referred to as Mobipoints, which is a more colloquial term for eHUBs in Flemish.

2. Methods

Research was conducted in two cities: Amsterdam (the Netherlands) and Leuven (Belgium). These two cities were selected from the six cities in the eHUBs project because of differences in their context (large versus small, cycling culture versus car culture, flat versus hilly), which in turn might influence behaviour factors. Research was conducted through one online survey and 12 telephonic interviews per city.

2.1 Survey

An online survey was distributed to car owners in both cities in September 2020, in cooperation with Stadspanel Amsterdam and the research company Dynata for the distribution of the online survey in both cities, and the Municipality of Leuven for feedback on the Flemish version of the survey². For the city of Amsterdam, 668 car owners started the survey, and 564 of those responses contained enough answers to be used for statistical analysis. For the city of Leuven, 257 car owners started the survey, and 254 of those responses contained enough answers to be used for statistical analysis. The survey included questions on a 5- or a 7-point Likert scale, questions with categories, and open-ended questions. Open-ended, categorical, and Likert-scale questions all included an additional option not to provide an answer to a question ('I don't know/no answer'). Frequencies, correlations, t-tests, analysis of variances, and regressions were used for data analysis. Answers to open-ended questions were coded into categories. At the end of the survey, respondents were asked whether the research team could contact them for a 15-minute follow-up interview on the topic of shared electric mobility.

2.1.1 Amsterdam sample

In Amsterdam, 320 men (57%) and 235 women were surveyed (average age, 58 years). Most respondents were highly educated (77%). All respondents had at least one car, 8.4% had two cars, and 1.1% had more than two. Most car owners in Amsterdam used their car between one and three times a week (50%), rather than four to seven times a week (35%) or between one and three times a month or less (15%). With regard to transport mode, 22% of respondents indicated that they viewed themselves mainly as a car driver, 37% as a cyclist, 3% as a public transport user, and 33% as someone who uses a mix of modes.

2.1.2 Leuven sample

In Leuven, 154 men (61%) and 99 women were surveyed (average age, 55 years). Most respondents were highly educated (60%). All respondents had at least one car, 26% had two cars, and 5% had more than two. Most car owners in Leuven used their car four to seven times a week (56%), rather than one to three times a week (38%) or between one and three times a month or less (6%). With regard to transport mode, 47% of respondents indicated that they viewed themselves mainly as a car driver, 18% as a cyclist, 6% as a public transport user, and 22% as someone who uses a mix of modes.

2.2 In-depth interviews

Interviews were held with 12 car owners in each of the two cities surveyed. They lasted approximately 15 minutes and were conducted by telephone because of Covid-19 measures in both the Netherlands and Belgium. The Amsterdam interviews were held in November 2020, and the Leuven interviews were conducted in February 2021. The sample of interview respondents was composed of an equal distribution of sex, age, educational level, and number of cars in the household.

Interviews were used in addition to the survey with the aim of exploring, in-depth, car owners' motives for trying out shared electric vehicles from eHUBs, because the survey revealed that motives were the most influential factor determining interest in availing of an eHUB. In the interviews, respondents were asked why they would use, or refrain from using, shared electric mobility from eHUBs in their city. Following their answers, the researchers mapped the various motives determining respondents' intention to use or not use shared electric mobility from eHUBs. The researchers categorised motives into one of three categories, according to Lindenberg and Steg's (2007) goal-frame theory:

- The gain motive: protecting or increasing personal resources, such as money or status;
- The hedonic motive: increasing positive feelings, such as feelings of joy and comfort;
- The normative motive: acting in line with personal or societal values.

The 12 respondents in Amsterdam varied in age from 25 to 71 years old (average age, 50.3 years), with seven women interviewed and five men. The 12 respondents in Leuven consisted of six men and six women, ranging from 18 to 68 years of age (average age, 45 years).

3. Main results

In general, car owners in Amsterdam and Leuven seem positive about the prospect of having eHUBs in their cities. Many car owners see the potential of shared electric mobility to solve various issues (less pollution, fewer traffic jams, climate change) if an increasing number of citizens stop using privately owned fossil-fuel cars. However, they show less interest in using eHUBs themselves, as they are satisfied with their private car, which suits their mobility needs. To make eHUBs attractive for car owners, policymakers and shared mobility providers face the challenge of altering car owners' cost-benefit analysis of their preferred mode of transport. Simply put, the chance of car owners altering their travel behaviour increases as their perceived benefits of using shared electric mobility go up and their perceived costs of shared electric mobility go down, or vice versa, when the benefits of private car ownership go down and costs go up. In this section, we describe the main barriers to, and motives for, car owners trying out eHUBs.

3.1 Car owners' interest in eHUBs

The majority of respondents in both cities (Amsterdam 70%, Leuven 65%) indicated that they saw eHUBs as a valuable addition to their city. When car drivers were asked to rank 'Trying out a vehicle from an eHUB' from 1 (very bad idea) to 10 (very good idea), the average in both cities was moderately positive (Amsterdam 6.5, Leuven 6.3). Interest dropped when they were asked more concrete questions about their intention to try out an eHUB vehicle. If such an option was available in their neighbourhood today, only one fifth of respondents indicated that they were likely to try out a vehicle from the eHUB in the coming month (Amsterdam 23%, Leuven 22%). Figure 1 displays the relative percentage likelihood of car owners in each city trying out an eHUB. The majority of respondents deemed it (highly) unlikely that they would try out a vehicle from an eHUB in the coming month if it was available in their street.

How likely is it that you would try out a vehicle from the eHUB in the coming month?

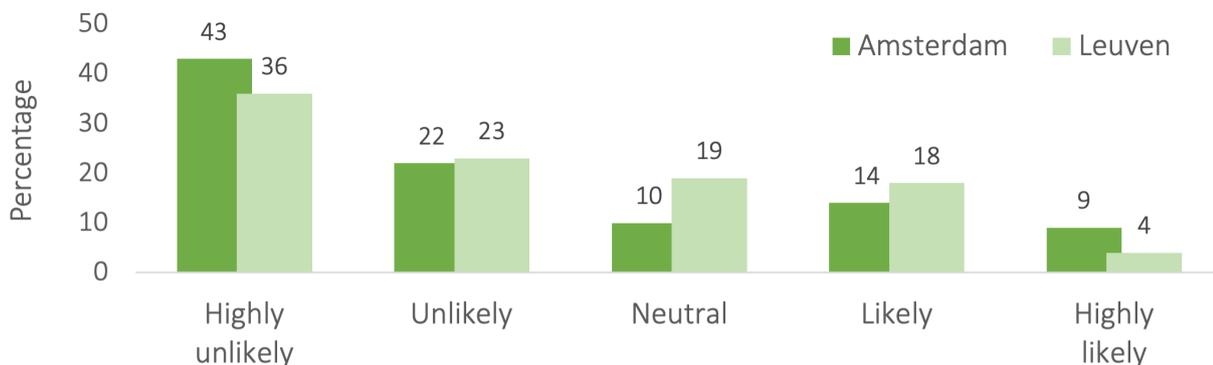


Figure 1 Intention of car owners in Amsterdam (n=564) and Leuven (n=257) to try out a vehicle from an eHUB if it was placed in their neighbourhood.

When asked to indicate their agreement with the statement 'Trying out an eHUB is not interesting to me as I have my own transportation', 71% of car owners in Amsterdam and 70% in Leuven agreed.

3.2 Main reasons for trying out vehicles from the eHUB

To ascertain the differences in car owners' intentions to try out a vehicle from an eHUB, we applied two research methods. First, we asked car owners to write down their most important reason for wanting or not wanting to try out a vehicle from an eHUB. Second, we statistically tested the factors assessed in our eHUBs survey that can explain the differences between car owners in their intention to try out eHUBs.

3.2.1 Asking car owners for their most important reasons

Through an open question, car owners were asked to note their most important reason for wanting or not wanting to try out the eHUBs. Some of their answers contained more than one reason. First, we asked all car owners their most important reason for not trying the eHUBs. In Amsterdam, 495 car owners answered this question and together provided 632 reasons for not trying out eHUBs. In Leuven, 166 car owners gave 189 reasons. Sorting the answers resulted in eight main categories of most important reasons for not wanting to try out eHUBs, see Figure 2. Car owners' main reasons for not wanting to try such a vehicle were that they simply did not see a need to do so, the costs involved with usage, the need to plan ahead, the expected hassle

with registration and 'figuring out how it works', having other travel needs, safety concerns, having to travel a distance to get to the vehicle, and a preference for ownership. These are explained as follows.

- 1. No need.** Many car owners (44% in Amsterdam, 27% in Leuven) indicated that their main reason for not wanting to try out eHUBs was that their mobility needs were already met with the vehicle(s) that they own, so they did not perceive any use in trying out the vehicles from eHUBs. They stated: 'I have my own car and parking space'. Moreover, many indicated a preference for their own bicycle as an alternative to their car rather than a vehicle from the eHUB: 'I already have a bicycle, so an electric bike is not necessary'.

What would be your main reason for not trying out the eHUB?

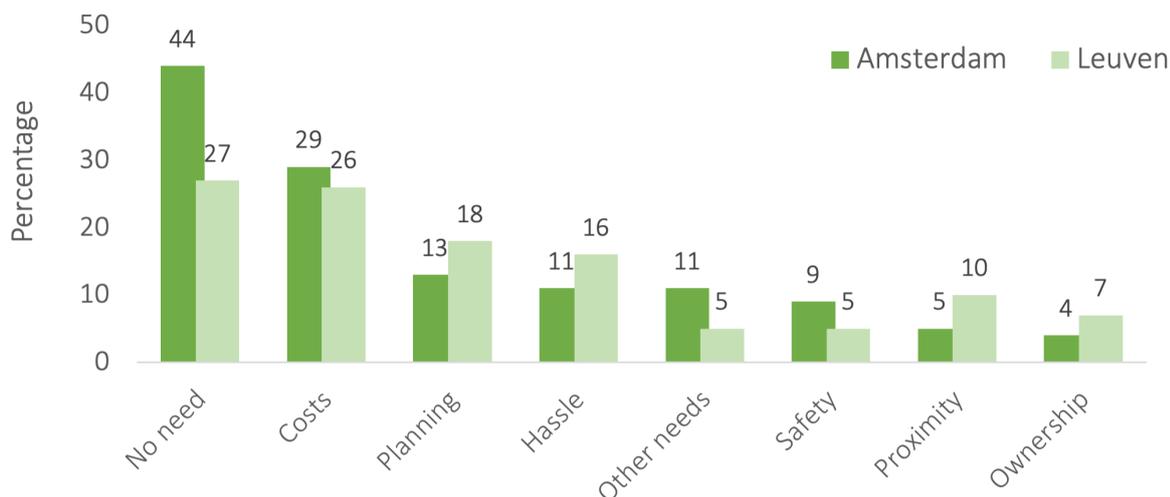


Figure 2 Categories of reasons given by car owners in Amsterdam and Leuven for not trying out a vehicle from an eHUB if it was placed in their neighbourhood. The percentages were calculated by dividing the number of answers in each category by the total number of car owners who answered the question (Amsterdam N = 495; Leuven N = 166).

- 2. Costs.** The second reason most often mentioned by car owners for not trying out eHUBs was the cost involved with using eHUBs (Amsterdam 29%, Leuven 26%). Trying out eHUBs entails additional cost on top of the costs for private ownership. Car owners compared the costs of fuel with the costs for using eHUBs. Car owners indicated: 'I have already invested in my own means of transport. [...] So double costs', or 'Because it is more expensive than taking my own bike or car'. Frequent drivers, in particular, calculated that, for more frequent usage of the eHUB, costs would accumulate and be higher than the cost of using their own vehicle: 'Because I need my car almost every day and for longer than half a day, it becomes far too expensive'.
- 3. Planning.** Having a car gives car owners the opportunity to leave spontaneously whenever they decide. Using shared mobility services from an eHUB requires planning and making a reservation. For various car owners (Amsterdam 13%, Leuven 18%), this necessity was the most important reason for not being interested in trying out an eHUB. Respondents wanted to have the freedom to use a car or a bike when they needed it: 'I rarely plan anything and go somewhere spontaneously. At that moment, I decide which means of transport to take. That is almost always my own bicycle, then, if it is in the city, always public transport and, outside the city, my car, which is within easy reach', and 'Shared transport does not work because then I lose my independence'.
- 4. Hassle.** Various car owners (Amsterdam 11%, Leuven 16%) indicated that the hassle of figuring out how it works, the smartphone use, or 'the administration' were their most important obstacles to trying out eHUBs: 'administrative hassle' and 'hassle with smartphone'.
- 5. Other travel needs.** For some car owners (Amsterdam 11%, Leuven 5%), eHUBs simply did not fit their travel needs, for example when they viewed their everyday travel time as too long or too sporadic for shared transport or when the shared vehicle options did not match their requirements (e.g., the size of available luggage space). A car driver indicated for example: 'This is not relevant for me. I usually drive long distances and stay away for a long time'.
- 6. Safety.** The importance of hygiene (and lack thereof) is frequently associated with the risk of contracting Covid-19. Expected wear and tear is often linked to the risk of unsafe cars and resulting dangerous situations. Car owners indicated: 'Dirty, high wear due to frequent and different use', and 'Corona and hygiene, don't know who used it before me'. For some car owners (Amsterdam 9%, Leuven 5%), the expected (poor)

condition of the shared vehicles, particularly of shared cars, was the most important obstacle.

- 7. Proximity.** The eHUBs may not be available close by, or in certain parts of the city or neighbourhoods. A few car owners indicated that having to walk a long way to use shared transport or being dependent on a specific eHUB location would be their most important barrier to trying out eHUBs (Amsterdam 5%, Leuven 10%). A car owner indicated: 'Most trips are for commuting. My car is at the door and is definitely available. I am not weather dependent, and it takes no extra time to walk to a shared car. A shared car location is unlikely to be within a 5-minute walk, given where I live'.
- 8. Preference for ownership.** A few car owners indicated that sharing was the most important barrier, as they preferred their own transportation and did not want to share with people they did not know (Amsterdam 4%, Leuven 7%). A car owner indicated: 'I like to cycle with my own pedals', and 'My own car is better'.

Car owners who indicated that they felt neutral or positive about trying out an eHUB were asked to indicate their most important reasons for trying it out. In Amsterdam, 361 car owners answered the question and together provided 443 reasons for trying out eHUBs. In Leuven, 130 car owners gave 145 reasons. Sorting the answers resulted in seven categories of most important reasons for wanting to try out an eHUB, see Figure 3. The percentages in Figure 3 were calculated by dividing the number of answers in each category by the total number of car owners who answered the question (Amsterdam n = 361; Leuven n = 130). This means that the percentage reflects the extent to which a reason was important to people who were already open to trying an eHUB, rather than reflective of the general attitude of car owners. Car owners who felt neutral or positive about trying out an eHUB would want to try an eHUB mainly out of curiosity, or because of attractive pricing, convenience, not possessing a vehicle that is offered in an eHUB, environmental concerns, availability nearby, and necessity when their own vehicle is unavailable.

What would be your main reason for trying out the eHUB?

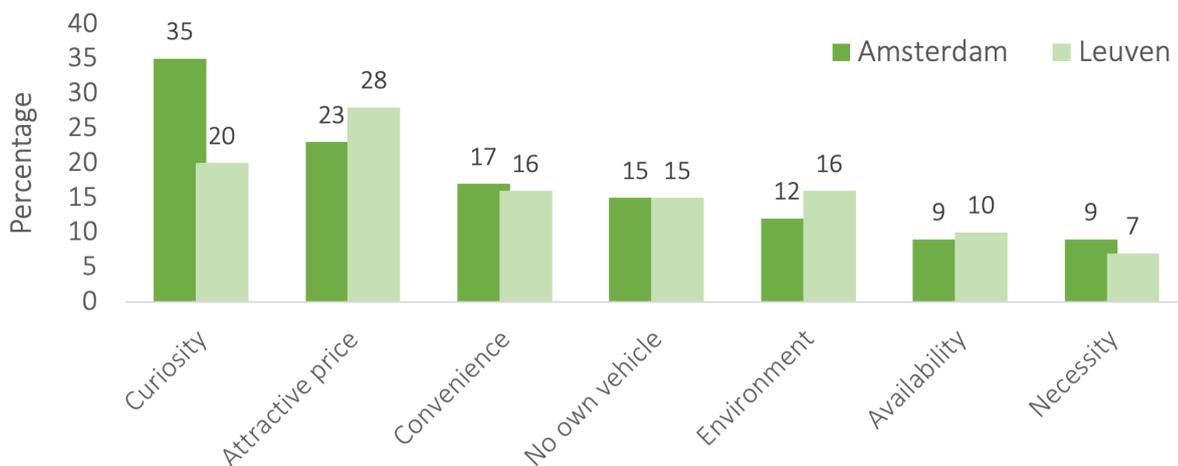


Figure 3 Categories of reasons given by car owners in Amsterdam and Leuven for trying out a vehicle from an eHUB if it was placed in their neighbourhood. The percentages were calculated by dividing the number of answers in each category by the total number of car owners who answered the question (Amsterdam n=361; Leuven n=130).

Car owners who were neutral about trying out the eHUBs mentioned the following reasons for trying out a shared e-vehicle from an eHUB:

- 1. Curiosity.** The reason most mentioned by car owners for trying out a vehicle from an eHUB was curiosity (Amsterdam 35%, Leuven 20%). Various respondents were unfamiliar with the concept and interested in how it worked. Several saw the eHUB as an opportunity to try new or unfamiliar electric vehicles without having to purchase them. They wrote: 'unsure about purchasing electric transport', 'fun to try', 'good chance to see what it's like'.
- 2. Attractive price.** The second most often mentioned reason for car owners to try an eHUB was (the possibility of) attractive pricing (Amsterdam 23%, Leuven 28%). Car owners indicated: 'Shared transport is cheaper than private transport', and 'If shared transport is cheaper than my own car, I would try it'. These responses indicate that a portion of car owners perceived the price as attractive, it is cheaper for them. For others, pricing could be a reason, but they lacked information to compare it with the costs of their car and said: 'If it is cheaper'.

3. **Convenience.** For some car owners (Amsterdam 17%, Leuven 16%), the most important reason for trying out a vehicle was convenience; for example: convenient for short distances, convenient when current transport mode is used little, convenient for cycling longer distances.
4. **Not possessing a vehicle.** For some car owners (15% in both Amsterdam and Leuven), the most important reason for trying out a vehicle from the eHUB was not having to own such a vehicle themselves, for example an e-bike.
5. **Environmental concern.** For a few car owners (Amsterdam 12%, Leuven 16%), the most important reason for trying out an eHUB was because 'Shared transport is good for the environment', or 'It is good to contribute to a clean environment'.
6. **Availability nearby.** A few car owners (Amsterdam 9%, Leuven 10%) indicated that the availability of an eHUB nearby was the most important reason for them to try out an eHUB. Responses included: 'I like to have transportation available at the doorstep' or 'Shared transportation should be nearby and then I would try it'.
7. **Necessity.** If for some reason their main means of transport was not available, several car owners indicated that this would be a reason for them to try out a vehicle from an eHUB (Amsterdam 9%, Leuven 7%); for example, when their car breaks down or will not start, flat tyre, having to cycle somewhere and not having appropriate transportation, or partner is using their car.

3.2.2 Behavioural model to explain when car owners will try out eHUBs

In addition to questioning car owners directly about their most important reason for (not) trying out the eHUBs, we ran statistical analyses on the answers that respondents gave in our survey. Extensive literature research allowed us to select the most important determinants for trying out eHUBs from an overview of all possible factors that can contribute to changes in travel behaviour. This selection formed the basis of our survey. We structured our survey following Michie's COM-B model (2010), which assumes that behaviour can only manifest when three requirements are met: there is sufficient capacity, opportunity, and motivation to behave in a certain way, see Figure 4. In this case, the target behaviour that we researched was 'trying out' eHUBs. The statistical analyses revealed the most important predictors among our carefully selected factors that determined whether car owners were interested in trying out shared electric mobility.

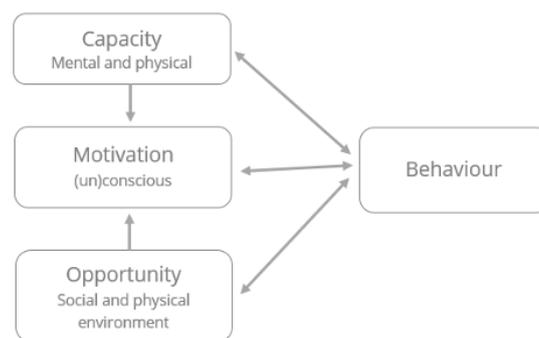


Figure 4 schematic representation COM-B model

3.2.3 Factors underlying intention to try out eHUBs

Multivariate regression analysis revealed that two to three factors statistically determined the degree to which car owners were interested in trying out shared mobility through an eHUB in Amsterdam (Figure 5) and Leuven (Figure 6), respectively. The factors differ for both cities, indicating that contextual differences influence how car owners make decisions.

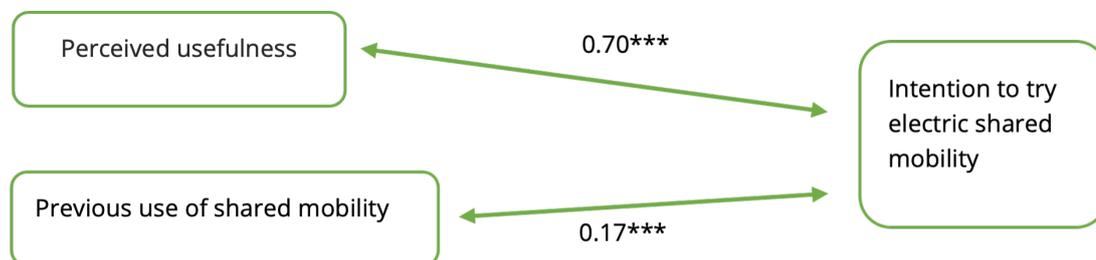


Figure 5 Behavioural determinants of car owners' intention to try out electric shared mobility in Amsterdam. Note: *p < .05, **p < .01, ***p < .001, N = 292, R2 = .47

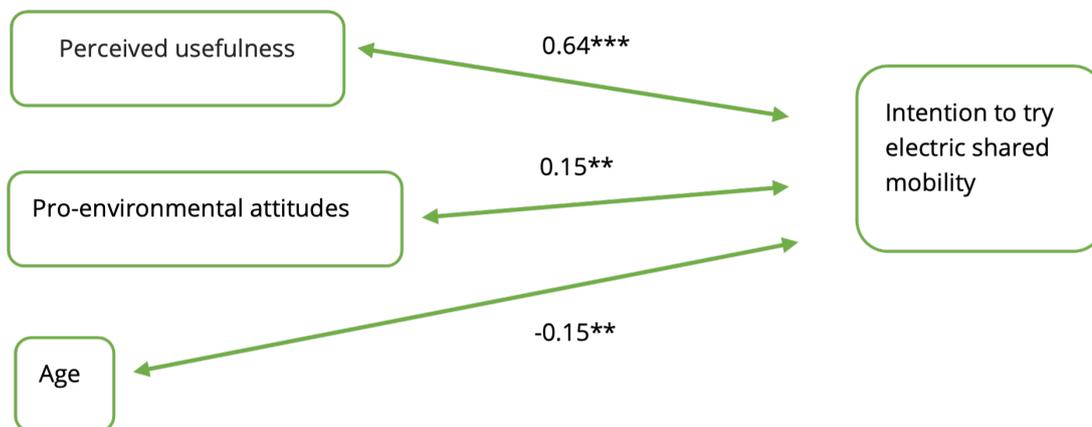


Figure 6 Behavioural determinants of car owners' intention to try out electric shared mobility in Leuven.
 Note: * $p < .05$, ** $p < .01$, *** $p < .001$, $N = 177$, $R^2 = .51$

Both cities: Perceived usefulness

In both cities, the most important predictor determining whether car owners intended to try out an eHUB was their perceived usefulness of trying out an eHUB; or, in other words, when the perceived benefits outweigh the perceived costs. Perceived usefulness was operationalised in survey items distinguishing three different types of usefulness – gain, hedonic, and normative – based on goal-framing theory (Lindenberg & Steg, 2007), see also section 2.2. From a gain perspective, car owners will use an eHUB only when they think it will improve their personal situation (e.g., it is cheaper or quicker compared to other mobility options or it will be status improving). For example, we asked car owners to indicate their agreement with statements such as 'Shared mobility from an eHUB seems more financially appealing than ownership'. In Amsterdam, 22% agreed and in Leuven, 33%. From a hedonic perspective, trying out an eHUB has perceived usefulness when it contributes to feelings of pleasure, e.g., driving an electric modality is fun and pleasant and arouses comfortable feelings. A little less than half of respondents indicated that they expected trying out a vehicle from the eHUB to be fun (44% in Amsterdam, 46% in Leuven). Lastly, from a normative perspective, eHUBs could enhance perceived usefulness if trying out the eHUB is in line with personal values or it is good to do because the environment would benefit from it. More car owners in Amsterdam (46%) than in Leuven (33%) indicated that trying out eHUBs was in line with their values. Statistically, the survey data show that the three motives have a strong positive association with one another. Taken together, they considerably increase car owners' intention to try out an eHUB (Amsterdam $B = 0.69$, $p < .001$; Leuven $B = 0.65$, $p < .001$).

Amsterdam: Experience with shared mobility

In Amsterdam, experience with shared mobility was the second factor determining whether car owners were interested in trying out shared mobility. The degree to which car owners in Amsterdam wanted to try out a vehicle from an eHUB was greater when they had previously used shared mobility ($B = 0.19$, $p < .001$). In Leuven, car owners' previous experience with shared mobility was not a significant factor related to their likelihood of trying an eHUB. The majority of the questioned car owners in both cities never used shared mobility before. In Amsterdam, 61% of questioned car owners indicated never having used shared mobility, and in Leuven 91%.

Leuven: Pro-environmental attitudes and age

In Leuven, pro-environmental attitude was the second factor determining whether car owners were open to trying out the eHUBs. Car owners with strong pro-environmental attitudes were more open to trying out an eHUB, compared to car owners with weak pro-environmental attitudes ($B = 0.19$, $p < .01$). Overall, almost all car owners professed pro-environmental attitudes. The vast majority of respondents (84% in Leuven) agreed with: 'I find it important to live in a healthy and clean environment'. Almost all respondents regarded themselves as an environmentally conscious person (84% in Leuven). In Leuven, 38% of the questioned car owners indicated that they were trying to reduce their carbon footprint. Lastly, in Leuven, age predicted the intention to use eHUBs, with older car owners being less likely to try out an eHUB ($B = -0.17$, $p < .01$). In Amsterdam, neither pro-environmental attitudes nor age were significant factors related to the likelihood of trying an eHUB.

3.3 Main reason why car owners perceive trying out eHUBs as useful

Our results showed that perceived usefulness was the most important determinant for car owners in Amsterdam and in Leuven to try out a vehicle from an eHUB. For that reason, more insight into this factor and into why some car owners see more benefits than others can help us to understand how we can increase the perceived

usefulness of eHUBs. To obtain these insights, we conducted interviews with 12 car owners living in Amsterdam and 12 in Leuven. Furthermore, we carried out additional analyses on the answers in the survey.

3.3.1 interviews about perceived usefulness

Most of the interviewed car owners in both cities said that they were willing to try out eHUBs: 7 out of 12 interviewees in Amsterdam and 10 out of 12 interviewees in Leuven. These results are not in line with the results from the survey, in which a minority expressed interest in trying out eHUBs. These differences may arise from a selection effect: people who were interested in trying out eHUBs were also more willing to participate in our interviews. Besides those differences, the interviews mostly confirmed the picture that emerged from the survey responses. Car owners in both cities gave the same reasons with regard to perceived usefulness. A variety of reasons were given for positive attitude and intent towards trying out shared e-vehicles. Like the survey results, these motives were categorised following Lindenberg and Steg's (2007) goal-framing theory as gain, hedonic, and normative motives.

Gain motive

Many of the interviewees mentioned a gain motive as a reason for wanting to try out an eHUB. They indicated that they would like to use vehicles from an eHUB to gain experience with electric and shared vehicles, either because they were considering swapping their own vehicle for shared mobility or because they were thinking of buying an electric vehicle in the near future. An interviewee from Leuven expressed his belief that 'in the future, all vehicles will be driven electrically. The transition to electric cars is inevitable. Trying out electric vehicles from an eHUB is an easy way to become acquainted with electric driving' (man, 51). Furthermore, various practical reasons were given for the interest. In Amsterdam, interviewees said that eHUBs might come in handy when their own vehicles were not available; for example, when the vehicle was being used by someone else (e.g., their partner) or being serviced or repaired. Another practical reason related to flexibility in travel choice, for example when existing needs were better fulfilled by shared mobility. Think of taking a shared e-cargo bike with enough carrying capacity for a trip to the hardware store. In Leuven, people liked the idea of being able to use vehicles without having to own them. They would not have to worry about maintenance and liked the fact that it was easy and financially attractive to use different modalities. Secondly, some thought that shared vehicles from eHUBs provided an easy way to move within and around the city. An interviewee from Leuven stated that he would like to use an e-bike when travelling in the city. It would be easier than using his own vehicle, because he would be flexible in taking and leaving it in the city, without having to worry about taking care of it (man, 43).

Hedonic motive

Interviewees also mentioned that they would like to use electric mobility and/or shared mobility from eHUBs because it seemed fun to try out something new or to use electric vehicles. Interviewees from Amsterdam, for example, stated that 'I assume the vehicles are made in such a way that it is fun to use them' (woman, 38) and 'I see myself as an early adapter, which means I like to try out new technologies and products. I think it would be fun to try out an electric car [from an eHUB]' (man, 30). Furthermore, people said that they would consider using shared (e-)mobility as a fun activity, such as a bicycle tour.

Normative motive

Lastly, in Amsterdam and in Leuven, interviewees mentioned that their reason for wanting to use shared e-vehicles was the advantages for the environment of shared e-mobility compared with vehicles that run on polluting fuels. An interviewee from Leuven stated that 'as a younger woman, I find it important to think about the environment and reducing CO₂ emissions, for the future' (woman, 25).

Lack of interest

A minority of interviewees (five out of 12 in Amsterdam, two out of 12 in Leuven) indicated that they had no intention of trying out vehicles from an eHUB. The most important reason given for this lack of interest was that people did not see any reason to use vehicles from an eHUB. These interviewees said that they were satisfied with the current situation and the currently used vehicles. A quote: 'How I go to places is all sorted out. And I'm satisfied with that'. These interviewees saw more disadvantages than advantages for using eHUBs. They thought that they would have to travel longer distances to eHUBs than to their own vehicles and that it was financially unattractive. In Leuven, interviewees stated that they would consider using shared e-mobility from an eHUB only if they could not use their own vehicle.

3.3.2 Factors underlying perceived usefulness of trying out eHUBs

In addition to the interviews, we ran statistical analyses on the car owners' answers in the survey to ascertain the factors that contribute to the extent that car owners perceive trying out eHUBs as useful. Multivariate regression analyses showed that, in both cities, three factors influenced perceived usefulness most. These were, in order of relevance: (1) injunctive norms; (2) trust in shared electric mobility as a solution to problems in the city (i.e., response-efficacy); and (3) trust in the quality and safety of the vehicles, including the protection of users' privacy. In Amsterdam specifically, two additional factors emerged from our analyses: respondents' confidence in their own capacity (i.e., self-efficacy) to try out a new vehicle from the eHUB and their experience with travelling in different modes of transport (multimodality) (Figure 7). These factors are discussed further hereunder.

Injunctive norms

Social norms were relevant for the perceived usefulness of trying out eHUBs, specifically, the injunctive norms that constitute the socially determined consensual standards that describe how people should act, feel, and think in a given situation; in other words, what is considered as socially desirable. In both cities, car owners perceived trying out eHUBs as more useful when they believed that people in their immediate environment were positive about trying out eHUBs. Currently, the injunctive norm is skewed towards private car ownership. In both cities, only a quarter of the questioned car owners indicated that people in their immediate environment would appreciate it if they tried electric shared mobility (26% in Amsterdam, 23% in Leuven). The descriptive norm – the actual behaviour in which people engage – is even further skewed towards private car ownership. Only about one in 10 respondents indicated that people in their immediate environment used shared mobility (11% in Amsterdam, 11% in Leuven).

Response efficacy

Car owners in both cities were more likely to perceive trying out eHUBs as useful when they believed that eHUBs formed a solution to problems in the environment (of the city). In general, the car owners saw eHUBs as a potential solution to various problems in the city if many fellow car-owning citizens switched to electric shared mobility. Most car owners expected this to lead to cleaner air (75% in Amsterdam, 63% in Leuven) and to help combat climate change (63% in Amsterdam, 59% in Leuven). In addition, some car drivers expected this to cause a reduction in traffic jams (33% in Amsterdam, 46% in Leuven). However, there were also some concerns about eHUBs creating more rubbish in public spaces (27% in Amsterdam, 40% in Leuven) or overburdening the electricity network (35% in Amsterdam, 43% in Leuven).

Trust in service

Car owners in both cities were more likely to perceive trying out eHUBs as useful when they trusted in the quality and safety of the eHUBs' service and vehicles, including the protection of users' privacy. In general, car owners in Leuven were somewhat more trusting than car owners in Amsterdam. About half of the questioned car owners in both cities trusted in good service from the providers (50% in Amsterdam, 58% in Leuven) and trusted that the vehicles were of good quality (52% in Amsterdam, 59% in Leuven). In Leuven, 55% of the questioned car owners trusted that their privacy would be protected if they used shared mobility, whereas among car owners in Amsterdam the figure was 37%.

Self-efficacy

In Amsterdam specifically, car owners were more likely to perceive trying out eHUBs as useful when they felt confident that they were skilled enough to do so. Trying out a vehicle from the eHUB seemed complicated for 21% of the questioned car owners in Amsterdam (26% in Leuven). Most respondents in Amsterdam, 61%, did not expect to encounter any problems when trying out an eHUB for the first time (49% in Leuven). We also asked them to indicate how difficult they expected specific actions would be with regard to using an eHUB. Some of the questioned car owners found it difficult to download the app (6% in Amsterdam, 17% in Leuven), to make a reservation (7% in Amsterdam, 15% in Leuven), to start an electric vehicle (7% in Amsterdam, 10% in Leuven), drive with it (4% in Amsterdam, 9% in Leuven), or charge it (11% in Amsterdam, 23% in Leuven). About one in four expected some difficulty with planning a trip in such a way that the battery would not run out (24% in Amsterdam, 26% in Leuven).

Multimodality

In Amsterdam, car drivers were more likely to perceive trying out eHUBs as useful when they had experience with using more than one mode of transport in the course of a single trip; for example, when commuting from

home to work consisted of walking, cycling, and using public transport, or driving a car and cycling. In general, car drivers in Amsterdam indicated that for all or most trips they used a single mode of transport (Amsterdam 87%, Leuven 77%). In Amsterdam, 7% (Leuven 8%) of the questioned car owners indicated that about half of their trips consisted of multiple modes of transport, and 4% (Leuven 12%) indicated that most of their trips consisted of multiple modes.

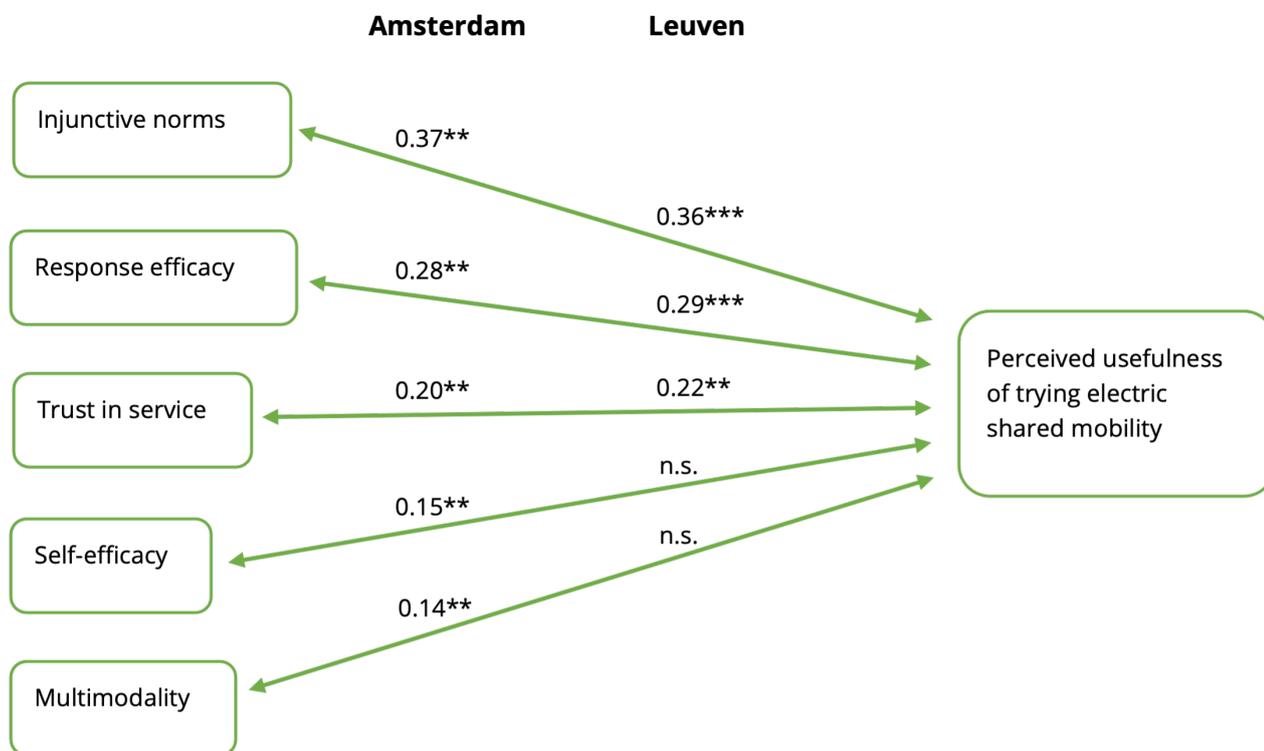


Figure 7 Behavioural determinants of car owners' perceived usefulness of trying out electric shared mobility in Amsterdam (N = 295, R² = .58) and Leuven (N = 177, R² = .49), respectively. Note: n.s. = not significant, *p < .05, **p < .01, ***p < .001.

3.3.3 Increasing perceived usefulness of trying out eHUBs

When car owners perceive trying out a vehicle from an eHUB as useful, this increases the likelihood that they will do so. Increasing car owners' perceived usefulness alters the cost-benefit analysis that car owners make for their preferred mode of transport, because it increases the perceived benefits of using shared electric mobility. The above results reveal the factors that contribute most to perceived usefulness and thus provide input on how to increase perceived usefulness. In the last section, we formulate recommendations to increase car owners' uptake of eHUBs.

4. Recommendations

The aim of this research was to ascertain car owners' motives for, and barriers to, trying out shared electric modalities. These insights can support the development of behavioural interventions intended to persuade car owners to try out shared electric vehicles from an eHUB. As behavioural scientists and drawing on the data gathered in our surveys and interviews, we have formulated several recommendations.

Recommendation 1: Address attentional bias

Most car owners, 70–71%, see no need to try out shared modes as they already own a vehicle. Data also show that car owners are largely satisfied with their private car; it fits their mobility needs. As they do not perceive any need to change, car owners will only absorb information that fits with their existing car routine, automatically filtering out messages about alternative travel modes. This selective focus on messaging is called attentional bias. To reach car owners, it is important to tackle this bias. This can be achieved by addressing car owners in a role with which they identify (e.g., 'Dear car owner, this may be of interest to you...') or addressing them when they are more open to alternative transport; for example, when their car is in for repairs or maintenance. Alternatively, car owners' attention could be drawn to messaging that is relevant to them, such as parking spots or prices.

Recommendation 2: Emphasise benefits of (trying out) shared mobility from different perspectives

Our results indicate that perceived usefulness is the most important determinant for car owners to try out a vehicle from an eHUB. Therefore, we recommend emphasising the benefits of (trying out) shared mobility to car owners. Three motives (gain, hedonic, and normative) have a strong positive association with one another. To increase car owners' uptake of eHUBs, all three goals can be addressed.

Firstly, regarding the gain motive, car owners are more likely to try eHUBs when they believe that this will improve their personal situation. A gain motive can be reinforced both financially and practically. With regard to the financial aspect, introductory discounts could help to increase the financial benefits and to reduce the financial burden of trying out shared mobility. In addition, car owners should be made aware of the true price of owning and using a private car. When car owners compare the cost of their privately owned car with the use of shared e-mobility, they will initially consider the eHUB cost as an additional cost on top of the costs for their car. They will compare the cost of the fuel for their car with the cost of renting a vehicle from the eHUB. The cost of insurance, road taxes, and maintenance is usually not included in the calculation. This means that there is an opportunity to increase people's understanding of the financial benefits of using eHUBs compared with private car ownership. Particularly groups with limited use of their private car may find it cheaper to use shared mobility. A disclaimer: financial motives are diffuse. People sometimes still choose the comfort of a private car even though it is more expensive. Regarding the practical aspect, expected and experienced hassle can form a barrier to car owners trying modalities from an eHUB. To increase the chance of a car owner trying a vehicle from an eHUB, reduce the attendant hassle by ensuring that trying out shared mobility is as easy and enjoyable as possible. Simplify the registration, offer a clear and accessible step-by-step manual on how to get started, and provide information on questions that customers may have regarding their use of the eHUB. Emphasise practical benefits of trying out a vehicle, such as gaining experience with electric mobility, learning how shared mobility works, and so on. Also, emphasise the practical advantages of the long-term use of eHUBs: user not being subject to the obligations associated with car ownership (e.g., periodic vehicle inspection), flexibility, a vehicle that fits a person's needs, and so on.

Secondly, regarding the hedonic motive, car owners are more likely to try eHUBs when they associate trying out with positive feelings or pleasure. Therefore, it is important to ensure that trying out shared mobility is a fun and pleasant experience in and of itself. Many car owners indicated that they were curious to find out what it would be like to drive an electric vehicle or were curious about using shared mobility. Communications to car owners about eHUBs could tap into this curiosity and contain messaging that is focused on the fun of trying something new. In addition, the hedonic motive can be made more salient by connecting trying out eHUBs with events that people like; for example, by making suggestions of fun places to go and see on the first ride (e.g., going on an e-cargo bike to the beach or taking an e-bike outside the city to cycle through a nature reserve).

Third, regarding the normative motive, car owners are more likely to try eHUBs when they believe that it will be beneficial to others/society. Emphasising the green framing of eHUBs creates positive associations. Showing how the uptake of eHUBs by car owners may result in cleaner air, less pollution, less traffic congestion, and a smaller contribution to climate change will increase the appeal of trying out an eHUB.

Recommendation 3: Change the environment

Provide an environment that makes car use and car ownership less attractive, thereby changing cost-benefit analyses of using eHUBs versus owning a car. Our research shows that car owners are mostly satisfied with their mode of transport. The current environment – both physical and social – is fitted to private car ownership, resulting in a cost-benefit trade-off in favour of the car. If the physical environment is designed in such a way that it is less attractive to own a private car, car owners will be encouraged to shift their travel behaviour. This is supported by a recent systematic review of reviews on low carbon mode adoption, which shows that it is primarily infrastructure that determines mobility mode choice, above individual or social characteristics (Javaid, Creutzig & Bamberg, 2020).

Recommendation specifically for Leuven

In Leuven, the intention to try out an eHUB was relatively stronger for younger car owners and citizens with a strong environmental concern. To quicken the uptake of eHUBs among car owners in Leuven, we advise

targeting younger car owners and car owners with high pro-environmental attitudes.

Recommendation specifically for Amsterdam

In Amsterdam, the intention to try out an eHUB was higher among car owners who had previously used shared mobility. In addition, car owners who were used to using multiple transport modes (multimodality) and who were confident in their ability to use shared electric modalities perceived trying out eHUBs as more useful. This shows that (practical) knowledge can support the willingness to try out an eHUB. To quicken the uptake of eHUBs among car owners in Amsterdam, we advise ensuring that more citizens become familiar with shared mobility and investing in opportunities for potential users to trial eHUB use.

5. Concluding remarks

Shared electric mobility offered in eHUBs is a possible partial solution for the mobility issues faced by many cities: it could contribute to keeping cities accessible, providing cleaner air, making the best possible use of public spaces, and ensuring that mobility is as emission-free as possible. eHUBs are only part of the solution when car owners change their travel behaviour by substituting their climate-unfriendly fossil-fuel car trips with active and/or clean forms of transport, like shared electric mobility. However, car owners seem satisfied with their car use and will not change their travel routines easily. To make shared electric mobility attractive for car owners, policymakers and shared mobility providers face the challenge of altering car owners' cost-benefit analysis of their preferred mode of transport. The current environment – both physical and social – is fitted to private car ownership, resulting in a cost-benefit trade-off in favour of the car. Car owners are more likely to alter their travel behaviour when the benefits that they perceive of using shared electric mobility go up and the costs go down, or vice versa, when the benefits that they perceive of private car ownership go down and the costs go up. So, policymakers and shared mobility providers should work together on creating an environment in which private car use and ownership is less attractive and shared electric mobility use is more attractive.

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