

# CO2 reduction through shared mobility: A review of psychological factors for the switch from a private car to shared transport

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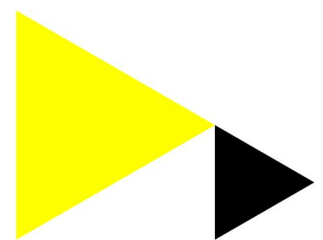
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# CO<sub>2</sub> reduction through shared mobility: A review of psychological factors for the switch from a private car to shared transport.

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## 1. Introduction

To fight climate change, the Netherlands aims to reduce its total CO<sub>2</sub> emissions by 55% by 2030. Road traffic, which accounts for 21% of total Dutch CO<sub>2</sub> emissions, is the second most polluting sector in the country. This problem only seems to be getting worse: on January 1, there were 8.9 million passenger cars, 1.7% more than a year earlier (Statistics Netherlands, 2022). CO<sub>2</sub> emissions from road traffic will therefore increase rather than decrease if no action is taken.

Electric shared transport is seen as one solution for reducing CO<sub>2</sub> emissions from passenger cars (Martin & Shaheen, 2011; Metz, 2013; Santos, 2018). In shared transport, vehicles are not privately owned, but rather shared by several people. This sharing can be commercial, in the form of a service where the customer pays only for use, or private, where the cost of the car is shared among the users. The potential CO<sub>2</sub> gains from electric shared transport are two-fold. On the one hand, the cleaner electric motor emits less CO<sub>2</sub> per kilometre than the fossil-fuel motor (Katzev, 2003). On the other hand, the number of cars is reduced: studies show that one shared car can replace as many as 23 private cars, and fewer kilometres are clocked up per vehicle when people switch to shared transport (Martin et al., 2016; Viegas et al., 2016).

However, the potential CO<sub>2</sub> reductions from electric shared transport can be realised only when people start making trips using cleaner electric shared transport instead of their currently more polluting transport modes. When shared transport is used instead of modes that are already sustainable such as walking, cycling, or public transport, CO<sub>2</sub> emissions can even increase. For maximum CO<sub>2</sub> gains, it is therefore essential that people start using electric shared vehicles instead of the fossil-fuel car. Realising the promising potential of shared transport for reducing CO<sub>2</sub> emissions thus seems to depend mainly on inducing a specific target group – car owners with fossil-fuel cars – to adjust its travel behaviour. Ultimately, this group must make the switch and exchange the private car for electric shared transport.

In essence, the transition from the polluting private car to electric shared transport is a behavioural issue. Car owners must exchange their own private car for electric shared transport. How can they be encouraged to do so? What are the (psychological) triggers and barriers that motivate this target group to make the switch or, on the contrary, prevent them from making the switch? In this paper, the results of a literature review are used to answer these questions. The insights offer avenues for solutions that can be used in the development of interventions aimed at stimulating the use of shared transport and reducing car ownership.

### 1.1 Understanding the behavioural determinants of motorists' use of shared transport

The potential benefits of electric shared transport in terms of reducing CO<sub>2</sub> emissions can be realised only when car owners exchange trips in their own fossil-fuel cars for trips in cleaner shared vehicles. Behavioural change is needed: people need to make different choices, break current patterns, and form new habits. An obvious precondition for this change is the presence of sufficient shared vehicles in the vicinity of the target group. However, behavioural sciences show that it takes more than just facilitating shared vehicles to encourage car owners to switch from their own cars to shared transport.

What is needed to get people moving can be explained using the COM-B model, part of the Behaviour Change Wheel (Michie et al., 2011). This model is an evidence-based behavioural model that provides insight into the conditions for behaviour. The model is often used in practice for behaviour change issues. It contends that behaviour (Behaviour) comes about when three preconditions are met.

First, people must be mentally and physically capable of carrying out the behaviour (Capability). For example, people must have the right knowledge, skills, and physical strength. Second, people must want to perform the behaviour (Motivation). These motivations include both conscious motives (think intentions, plans, and evaluations) and unconscious motives (think emotions, reflexes, and impulses). Finally, the social and physical environment must provide sufficient opportunity to carry out the behaviour, so certainly not hinder and preferably even stimulate it (Opportunity). This concerns both the social environment (namely, interpersonal influences, social cues, and norms) and the physical environment (think of the layout of the environment and available resources).

In addition to the direct influence of these components on behaviour, the components influence one another (see Figure 1). For example, possessing the right knowledge or the presence of a social norm that matches the behaviour can increase the motivation to perform the behaviour.

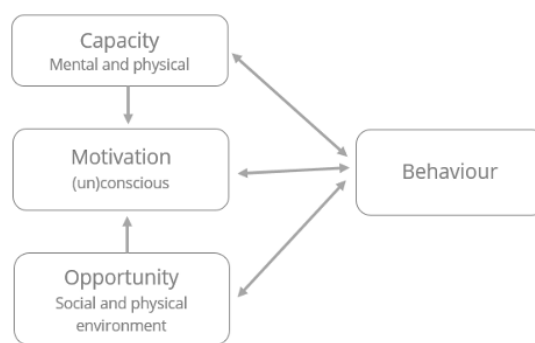


Figure 1. Visual representation of the COM-B model

When one of the three COM-B components is missing, the likelihood that the behaviour will be implemented is low. For shared transport use, it is therefore true that, in addition to the presence of shared vehicles, the car owner must have the right capacity and motivation. By means of a literature review, we investigated what exactly people need to be able to do and by what motives they are driven. This paper presents the results of this exploration. In addition to outlining the behavioural factors, we describe the challenges and opportunities for inducing car owners to use shared transport.

## 2. Method

The literature search consisted of a search and an analysis phase. These two phases are explained below.

### 2.1 Literature search strategy

In the search phase of the literature review, articles were sought both on the use of shared transport and on reducing car use. A broad approach was chosen because of the small number of existing articles on behavioural factors for the use of shared transport and in particular because of the lack of articles on behavioural factors for shared transport use by motorists. Using a search term scheme, we consulted the databases Google Scholar, JSTOR, SpringLink, and ScienceDirect to find scientific articles. Examples of search terms include: shared modalities usage, uptake shared mobility, access-based mobility, combined with for example psychological factors or determinants. During the search process, the focus was on mobility and products-as-a-service studies that focus on (travel) behaviour, use, or related psychological factors such as attitudes and motives. Subsequently, a further search was conducted by means of backward and forward reference searching: both sources that were mentioned in the found articles and the articles that cited the found articles were viewed and consulted when they appeared relevant. This search strategy ultimately yielded 101 relevant articles.

## 2.2 Analysis of articles

The literature analysis was conducted in two steps. The first step covered the study of the found (101) articles. Based on these articles, a longlist of behavioural factors that could influence the use of shared transport was created. Next, these factors were combined and classified into one of the three components in the COM-B model. Both steps are explained below.

### *Step 1: Inventory of behavioural factors from existing literature*

Based on the articles studied, a list was compiled of all factors that may play a role in the switch from private cars to shared transport. Next, the factors that corresponded in content were combined. As an example, all factors about feelings and emotions were merged into the behavioural factor 'affective determinants'. The 101 articles finally yielded a set of 23 behavioural factors that may play a role in the switch from private cars to shared transport. These behavioural factors were initially categorised based on the car owner's characteristics, shared transport, and the environment.

### *Step 2: Development of behavioural model based on the COM-B model*

The next step in the analysis process was to classify the behavioural factors into the COM-B model. Through several brainstorming sessions, we classified the factors into one of the three COM-B components. Factors with a lot of overlap were merged. For example, 'feelings of freedom' and 'uncertainty about using shared transport' were combined into the behavioural factor 'hedonic motive'. The 23 factors from Step 1 were thus finally compressed into eight behavioural determinants. These eight determinants are further explained in the following section.

## 3. From car owner to shared mobility user: the psychological determinants

Based on a literature review, eight behavioural determinants were identified that play a role in car owners' use of shared transport (see Figure 2). This section explains the various determinants for each behavioural component.

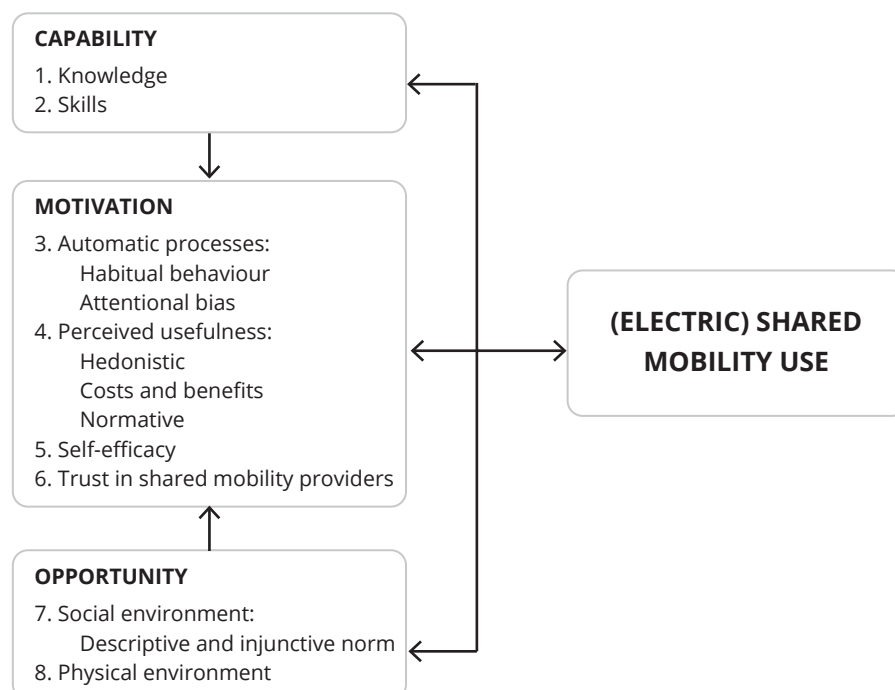


Figure 2. Behavioural determinants of car owners' use of shared transport

### **3.1 Capability**

One of the conditions for car owners to switch to shared transport is having the right knowledge and skills.

#### *Determinant 1. Knowledge*

Research shows that lack of knowledge about shared services and how shared transport works can deter people from using shared vehicles (Moeller & Wittkowski, 2010). Car owners need to know that shared transport exists as a service, where to find the providers and vehicles, and how to use the services and vehicles. In addition to driving and using shared vehicles, car owners also need knowledge about creating an account, downloading an app, and scheduling a ride with an electric (or non-electric) vehicle. This knowledge is a prerequisite for behavioural change, but by itself not enough to get people moving. Car owners must also be motivated enough and the environment must facilitate the behavioural change. Effective communication about the personal and collective advantages of shared transport (e.g., cheaper and more sustainable) and the disadvantages of owning a car (many cars on the road), can motivate people to try shared transport, initially while keeping their own car but with the long-term objective of discouraging car ownership.

#### *Determinant 2. Skills*

Different skills are needed to use shared transport. For people who have no previous experience with shared transport, these are often new skills that need to be learned: for example, how to drive and charge an electric shared vehicle, or how to plan the trip taking into account the limitations of the battery and the range of an electric vehicle, but also using the mobile app to reserve and unlock a means of transport is an action that is new. Research shows that the lack of the right digital and technological skills can hinder the use of a new technological innovation such as (electric) shared transport (Hsiao et al., 2018; Wang et al., 2003). In addition, a journey using shared transport is almost never door-to-door using a single transport mode. Someone has to go to the place where the vehicle can be picked up, but also the trip itself is often multimodal: a shared transport trip is regularly part of a whole chain of vehicles. Think, for example, of a trip where someone travels to the railway station by bike, from there they take the train, and then they borrow a shared bike at their destination. The use of such a chain of transport modes requires different skills. Research shows that people with low multimodal travel skills are less likely to use shared transport (Alonso-González et al., 2017). Research also shows, however, that these skills develop well. A Swedish experiment around long-term trials of shared transport showed that people with little multimodal travel experience, such as car owners, developed new skills and routines during the experiment, resulting in a decrease in private car use (Sopjani et al., 2020).

In addition to the direct relationship between skills and the use of shared transport, there is an indirect effect of skills on behaviour. For example, people without the right skills are less able to assess the benefits of services (van de Glind, 2013; Wang et al., 2003), which in turn affects their motivation and willingness to pay for and use shared services (Hsiao et al., 2018).

### **3.2 Motivation**

Motivation includes all the internal processes that drive people to certain behaviours; the drivers that cause people to do or pursue something. These can be either automatic, unconscious motivations such as habits and desires, or the more reflective conscious motivations where a person makes intentional plans. Several motives are associated in the literature with the use of shared transport. These are described below.

### **Determinant 3. Automatic processes**

Many of the drivers of human behaviour are unconscious. Reflexes, impulses, and habits play an important role in what people think and do (Hermsen & Renes, 2016); so too with the switch to shared transport by car owners. In particular, habitual behaviour seems to play an important role.

#### *Habitual behaviour*

Travel behaviour is often habitual: people generally use the same travel modes consistently. They automatically grab the same vehicles and like to take the same routes and usually do not consciously think about it (Thøgersen, 2006). This is especially true for trips that recur regularly, think of the daily commute to work. Once behaviour has become a habit, it takes more effort to change it (e.g., Graham-Rowe et al., 2011). This is also true for travel behaviour: multiple studies point towards habit formation as one reason why it is so difficult to get people out of the car and into alternative travel modes (e.g., Gärling et al., 2001; Thøgersen & Møller, 2008; Verplanken et al., 1994; Verplanken et al., 1998). Even when people have the intention to travel in an alternative way, they are likely to revert to their usual travel patterns (Staats et al., 2004; Verplanken et al., 1994). Breaking the current car routine is therefore an essential step in detaching car owners from their car.

Unlearning old travel habits and acquiring new travel habits – in which the use of electric shared transport is integrally embedded – takes time and energy (Lally & Gardner, 2013). Therefore, it is important that people are motivated enough during this process to successfully endure and sustain it (Sheeran et al., 2005). People can be helped in this process, by offering stimulating (extrinsic) incentives and removing factors that make the behaviour more difficult. Therefore, it is important to make shared transport use as easy as possible. When using a shared service involves too much hassle, users are likely to drop out and return to their old (car) habits.

#### *Attentional bias*

Unconscious motives also influence behaviour indirectly, through the way in which people process information about car sharing and transport (see also Determinant 1. Knowledge). Because of limited cognitive ability, people are selective in how they process information. Over the course of the day, people are constantly stimulated by their senses; they hear, see, and feel all kinds of things. If people were to process all these stimuli consciously, they would be cognitively exhausted at the end of the day. People are therefore continually busy (often unconsciously) selecting stimuli and information relevant to them from everything that demands attention. This is also called attentional bias: image formation and decisions are guided by existing thoughts, ideas, and previous experiences (Renes, 2021). For example, an advertisement about an electric car is more likely to be seen by people who are interested in buying an electric car than by people who are not. This attentional bias is a potential barrier to encouraging shared transport use through information provision to car owners (e.g., Aarts et al., 1997). Many people take owning their own car for granted and are also satisfied with their car use and current travel habits. It is therefore likely that information about shared transport will be subconsciously filtered out as irrelevant by this group. Providing information to this group about the advantages and possibilities of using shared transport therefore has little effect (e.g., Dahlstrand & Biel, 1997).

### **Determinant 4. Perceived usefulness**

When a new technology or innovation is introduced and ready for use, it is important that people perceive its benefits. It should add something to the existing situation; to what they know and already have (Rogers, 2010). The degree to which people see the benefits of behaviour (change) is also called perceived usefulness. Perceived usefulness is greater the more the user sees an added value from the product or service. People are more likely to see added value when they



care about the product or service and when its benefits are large and visible (Davis, 1993). When people see no or little benefit from using the new product or service, they are less likely to adopt it voluntarily. As previously noted, car owners are often satisfied with their car as a means of transport (Geertman & van Brecht, 2019; Kreemers et al., 2021). The car is seen by most car owners as a comfortable, flexible, and efficient way to travel (Kingham et al., 2001). As long as car owners do not see the added value of shared transport over using their own car, they are unlikely to use shared transport. Furthermore, people generally like to stick to the status quo, especially when satisfaction with the current situation is high (Samuelson & Zeckhauser, 1988). In addition, people are generally more sensitive to what they risk losing (loss aversion) than to what the new may bring them (Kahneman & Tversky, 2013). Car owners have often invested money and time in their car and, in many cases, they are used to having their own car. Giving up their own car will therefore be experienced as a loss by many car owners, and, as long as the added value of the alternative is uncertain, few will accept that loss.

To encourage people to give up their cars, it is therefore necessary that the added value of the alternative (shared transport) is felt sufficiently and that it meets the car owner's needs and goals. The literature shows that this added value can be fulfilled from three goal motives: hedonic, cost/benefit, and normative (Lindenberg & Steg, 2007). Given the importance of these three goal motives for the transition to shared transport, they are explained in more detail below.

#### *Hedonistic*

Hedonism revolves around positive, pleasurable feelings associated with an action. Wanting to experience pleasure and striving for a pleasant feeling are strong drivers of behaviour (Elliot, 2006; Lindenberg & Steg, 2007). This seems to be true for share transport as well: 'having fun' is one of the reasons that people cite for (first) using shared transport (Belk, 2014). For example, there are people who enjoy driving electric (shared) cars and therefore want to use electric sharing services (Ruhrt et al., 2014). However, the positive emotions related to one's own car can actually also hinder the use of shared transport. For example, feelings of freedom and flexibility are often cited as reasons for, and benefits of, owning and using one's own car (e.g., Steg, 2005), although something seems to be shifting among younger generations: feelings of freedom and flexibility for them do not seem to depend on (car) ownership but on the ability to use products when they are needed (Newman, 2011; Van & Fuji, 2011).

Just as positive feelings can encourage shared transport use, negative feelings can get in the way of use. When pursuing pleasure, people try to avoid negative experiences. This can cause people to be less motivated to try shared transport when they are unsure that it will be a pleasant experience, or – indeed – when they expect it to be an unpleasant experience. For example, research shows that people may be uncertain about using electric cars because different actions are required than for using fossil-fuel cars (e.g., Geertman & van Brecht, 2019). Research on the use of shared bikes found that fear of having to cycle on the road among other road users was a barrier to trying this mode of shared transport (Fishman et al., 2015). Also, the expectation that shared transport involves a lot of hassle may deter people. People appear more likely to try something new when it is easy and hassle free (Fishman et al., 2015; Karlsson et al., 2016; Ratilainen, 2017; de Vries et al., 2020). For example, people prefer to be able to rent a vehicle instantly (without a reservation or subscription) where payment can be made immediately with a debit card. When vehicles are not immediately available or the registration/reservation requires too much time or too many actions, people drop out, even when they were initially interested and motivated to try out the sharing services (Baumeister & Wangenheim, 2014; Durgee & O'Connor, 1995; Fishman et al., 2015; Lamberton & Rose, 2012).



The positive or negative feelings related to an action do not always come from one's own experiences. Often, people anticipate what they expect to come. For example, respondents in the Fishman et al. study (2015) who indicated that they would prefer not to cycle among other road users did not appear to have any concrete experience with the use of shared bikes and cycling on the road. It seems, therefore, that here it is primarily the unknown – and not being sure if it will be fun – that repels people. This phenomenon is known as uncertainty aversion (Ellsberg, 1961). People prefer the known to the unknown, even when the known carries more risk. This also applies to owning one's own car versus using shared transport. Shared transport is generally associated with more uncertainties, especially among people who are not yet familiar with it. People may worry about availability, the operation of the vehicle, whether the battery is charged, and so on – uncertainties that do not come into play when using one's own car. Research also shows that a guarantee of the availability of shared transport is one of the most important conditions for a person wanting to use shared transport (Kim et al., 2017).

#### *Costs and benefits*

In addition to people wanting to experience pleasure and striving to feel good, a second important goal motive is the rational assessment of what the behaviour will concretely yield or cost. Before people start doing something, they often make a cost and benefit analysis. When they feel that the new service or product will give them something concrete (more than just a positive experience), they are more likely to actually use it than when they expect it to cost them something. This seems to be true for shared transport as well. For example, research on car sharing shows that people who see more utility in shared transport are more likely to try shared transport (De Luca & Di Pace, 2014). Other studies show that the propensity to try out shared transport can be strengthened through an attractive trial offer with free rides or driving minutes (Fishman et al., 2015; Karlsson et al., 2016; Ratilainen, 2017). Drivers arising from a cost and benefit analysis can be divided into three categories: financial, practical, and status. The drivers can have different effects and thus play different roles in the use of shared transport.

- Financial drivers concern money-related costs and revenues associated with the use of shared transport. In general, the higher the perceived financial cost, the less attractive a transport option is evaluated (Holmberg et al., 2016; Ratilainen, 2017). If shared transport is perceived to be cheaper than using a private car, this may increase the attractiveness of shared transport (Mattia et al., 2019). However, it is not easy for people to make an accurate estimate of the financial costs and benefits. Research shows that car owners generally have a poor grasp of the costs of their own car and tend to underestimate them (Bonsall et al., 2004). For example, car owners often count only direct costs such as fuel and parking costs, and non-frequent and less visible costs, such as maintenance, insurance, and depreciation, are not included (Gardner & Abraham, 2007; Wardman et al., 2001; Andor et al., 2020). This can create the perception that running a car is cheaper than it actually is, and shared transport quickly appears more expensive than the private car, whereas, in fact, for car owners who clock up fewer than 15,000 kilometres per year, it is currently cheaper to switch to shared transport<sup>1</sup>. In addition, the importance of the price of a product or service is often overestimated by people themselves. People often cite cost as one of the main reasons for using or not using certain modes (e.g., Geertman & Van Brecht, 2019; Kamargianni et al., 2018). However, research shows that the actual relationship between cost and individual transport behaviour is small in the short run (Steg, 1996; Tertoolen, 1995). In reality, choices are more strongly driven by other, often unconscious factors. These include a need for freedom or the fact that travel behaviour is often habitual (Graham-Rowe et al., 2011).

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<sup>1</sup> See <https://www.verkeersnet.nl/duurzaamheid/35752/autodelen-in-belgie-goedkoper-dan-privewagen-tot-15-000-kilometer/>, consulted 15 November 2021.

- In addition to financial costs or benefits, people are driven by practical benefits or barriers. Shared transport has several practical advantages that can motivate people to use it. For example, trying out shared transport can provide an easy way to experience how electric vehicles work, without immediately being tied down to something (Kahn, 1995). This is relevant for people who are considering purchasing an electric vehicle or who are considering using shared transport more often. In addition, users do not have to maintain the shared vehicles, they can often park them more easily and cheaply, and there is more flexibility and choice because of being able to switch between different modes depending on the need. Also, people often pay only for their use (Kahn, 1995; Durgee & O'Connor, 1995; Lamberton & Rose, 2012; Spickermann et al., 2014). The opposite is also true: the more time and energy car owners expect to spend on the processes required to try out and use shared transport (the sign-up process with a provider, downloading an app, or reserving and using a vehicle), the less likely they are to consider or start using shared transport (Fishman et al., 2015; Karlsson et al., 2016; Ratilainen, 2017). These practical concerns play a significant inhibiting role in getting started with shared transport. For example, a Swedish experiment in which car owners tried out shared transport for three months shows that, prior to the experiment, car owners had concerns mainly about the practical ease of use of shared transport compared to the private car (Sopjani et al., 2020).
- In addition to practical and financial benefits, people are driven by the expected impact on their status. When the use of shared transport is seen as status enhancing, people can be enticed to use it. For example, research shows that people who value sustainability are attracted to shared transport providers with electric cars because it allows them to manifest their green identity (Griskevicius et al., 2010). The opposite also plays a role: car owners can derive status from their car. Car owners who do so tend to be more negative about car sharing (e.g., Stradling et al., 1999; Dittmar, 1992). In addition, renting (rather than owning) may be associated with having few financial resources and lower status. This perception may deter people from renting and sharing (Bardhi & Eckhardt, 2012).

#### *Normative*

How people make choices and act is determined not only by hedonism and a cost/benefit analysis, but also by personal norms and values (Lindenberg & Steg, 2007). These are underlying ideals and personal rules that guide and drive goal setting and choice making. Research shows that personal norms and values play a role in sustainable behaviours (Stern, 2000). This also seems to apply to travel behaviour and choosing more sustainable transportation alternatives (e.g., Bamberg et al., 2007).

Shared mobility has the advantage of having a less negative impact on the environment. This fact moves people from the more polluting private car to shared mobility for sustainability reasons. How big a role these sustainability motives play in the use of shared transport is a frequent subject of research. However, the results from these studies are not unequivocal. Several studies show that sustainability motives and biospheric values are important predictors of sustainable behaviours such as shared transport use (Bamberg et al., 2007; Kaiser & Shomoda, 1999). These studies suggest that the choice of shared transport follows from a moral obligation to act sustainably (Stern et al., 1999; Stern, 2000; Whittle et al., 2019). At the same time, there are studies that find a smaller role for sustainability motives as drivers. These studies conclude that individual motives such as cost savings or service quality are decisive and motivate usage (Reinhardt & Gurtner, 2015; Botsman & Rogers, 2011; Hartl et al., 2018; Möhlmann, 2015; Schaefers, 2013). The environmental benefits are then often felt and appreciated, but seen mainly as a nice side effect (Hartl et al., 2018).

Despite the fact that studies are ambiguous about the role of sustainability motives, it seems sensible to take them into account when promoting shared transport use is the goal. For example,

it appears that people with higher biospheric values are more likely to act sustainably (Stern, 2000). This is because people with biospheric values like to act on these ideals and therefore feel morally obligated to make sustainable choices (Lind et al., 2015). This moral sense can be activated by making people aware of the risks and consequences of unsustainable actions for themselves and the collective (Nordlund & Garvill, 2003). For behavioural interventions, it may therefore make sense to focus on raising awareness of those risks, because of the triggering of biospheric values and thus the arousal of feelings of moral obligation and ultimately sustainable behaviour.

Research by Evans and colleagues (2013) on self-transcending motives – motives that focus on others and the collective (think protecting the environment) rather than on the individual – shows that such motives lead to a positive spill-over effect. People who opt for shared transport based on knowledge of collective sustainability benefits ('good for climate and society') are also more likely to recycle than people who opt for shared transport based on knowledge of individual benefits ('good for me'). This suggests that, to stimulate sustainable behaviour, it is important to think about the knock-on effects of the strategy. A strategy that places a lot of emphasis on individual benefits may well encourage people to use shared transport, but it does not necessarily make them intrinsically enthusiastic about climate-friendly action. The behaviour therefore has a rather shaky (extrinsic) foundation and can easily be discontinued when the individual benefits of the behaviour disappoint or disappear. In contrast, a strategy that emphasises collective, self-transcending motives may not get everyone excited at first, but, when it does encourage people to try shared transport, it leads to more robust behaviour change. More research is needed to better understand how normative drivers can best be used to move people towards shared transport.

#### ***Determinant 5. Self-efficacy***

Apart from goal motives, knowledge, and skills, people's willingness to perform different behaviours is related to whether they believe that they are capable of performing these behaviours. Thus, they subjectively assess that they have sufficient knowledge and skills. As described earlier, using (electric) shared transport requires different actions and skills than using a private car. Think about unlocking shared vehicles or charging electric vehicles. If car owners are uncertain about whether they have the right knowledge and skills needed to use (electric) shared transport, they are unlikely to start (Zhua et al., 2011). A high level of confidence in one's own abilities is therefore an important prerequisite for the first use of (electric) shared transport.

#### **Determinant 6. Trust in shared mobility providers**

In addition to trust in one's own ability, trust in providers is an important condition for the use of new services (Papadopoulou et al., 2001). When a provider has a poor reputation and trust is low, people are less likely to use it (Catulli, 2012; Cronin & Taylor, 1992; Fornell et al., 1996). Satisfaction with actually using a shared service is also determined by the amount of trust one has in the shared transport provider (Mohlmann, 2015). Trust in a provider occurs when one believes that it is reliable and the use of the service (including payments) is safe (Wirtz & Lwin, 2009). Poor conditions, for example due to poor service or dirty vehicles, have a negative impact on the level of trust in a provider (Catulli, 2012).

### **3.3 Opportunity**

Opportunity is the third component of the COM-B model that is important for behaviour. It refers to all factors in the environment that hinder or enable the performance of behaviour. These include factors in the physical environment, such as the design of the environment or the resources available

to someone (Binney et al., 2003). In addition, it involves the social environment, for example social cues or norms that act as unwritten rules about how one should behave (Lindenberg, 2018). Indeed, research shows that various aspects from the social and physical environment influence the use of shared transport.

#### ***Determinant 7. Social environment***

The social environment plays an important role in the creation of behaviour. People are both consciously and unconsciously influenced by what others think is normal to do (the injunctive norm) and by what others actually do (the descriptive norm) (Cialdini et al., 1990). A systematic review of reviews pooling results from 75 reviews of mobility behaviours shows that both the descriptive norm and the injunctive norm play an important role in making mobility behaviours more sustainable (Javaid et al., 2020).

The injunctive norm (the prevailing normative beliefs) plays an important role in the formation of travel behaviour. This norm informs people about what others disapprove of and approve of. Such beliefs, norms, values, and rules of the social environment provide people with tools to behave 'correctly', thus preventing them from falling out of the group (Cialdini et al., 1990). Current injunctive travel norms are currently a barrier to car owners' uptake of shared transport (Steg, 2005). Despite the fact that car owners now often view the concept positively, they see it mainly as an interesting service for others and not for themselves (Hartl et al., 2018; Nobis, 2006). One reason for this is that people sometimes associate renting or sharing vehicles with having too little money to buy a vehicle themselves or a lower social status (Bardhi & Eckhardt, 2012). This perception hinders shared transport use among people who do not (want to) identify with it, such as car owners.

People let their behaviour be guided not only by what others think and feel, but also by what they actually see others around them doing. This descriptive norm is a strong influencer of behaviour. People tend to follow others and do what others around them do. The descriptive norm plays an important role in bringing about behaviour. For example, this norm is generally decisive in situations with conflicting norms. Think of a traffic light: the light indicates what the intention is ('don't cross when the light is red'), but, when many others disregard the red, people will still be inclined to do so (and vice versa).

The importance of the role of the descriptive norm also applies to shared transport: people are more inclined to try shared transport if they see and hear that others in their (close) social environment use shared transport. However, currently, the majority of the Western European population still own and use their own car (Pew Research Center, 2015). Car use is normal and visible: there are many cars on the road, traffic jams are a normal phenomenon, and streets are full of parked cars (Steg, 1996). In contrast, shared car use is much less common and visible (e.g., Geertman & van Brecht, 2019). In 2018 and 2019 in the Netherlands, on average only 0.1% of all travelers used a shared vehicle for at least one of their trips (Jorritsma et al., 2020). In order to increase the likelihood of people using shared transport, shared transport use must become more normal. For this to happen, the user group needs to grow and the use of shared transport needs to become more visible, and for this it is important that people can identify with this user group. If, for example, mainly young people use public transport, older people will not feel attracted to using public transport. In addition, make sure that the actual use is visible. Visibility of unused parked vehicles on the street can communicate the wrong norm, namely, 'shared vehicles are not used'.

#### **Determinant 8. Physical environment**

Factors in the physical environment play an important, especially conditional, role in the use of shared transport. For example, the presence of shared transport is a logical condition for its use. The distance the user has to travel to a shared vehicle plays a role here: if a shared vehicle is too far away, use is unlikely (Brown et al., 2016; De Luca & Di Pace, 2015; Kabra et al., 2019). Swedish research shows that people are willing to walk a maximum of 300 metres to a shared car (Karlsson et al., 2016). Other studies on shared transport in general show similar results (Bachand-Marleau et al., 2012; Fishman et al., 2015; Kabra et al., 2019). Not only the presence, but also the visibility of shared vehicles in the physical environment is important. The more visible a shared vehicle is, the more likely it is to be used. Sharing vehicle locations can be made visible with clear signage such as columns, signs, or ground markings.

A systematic review of reviews into the psychological factors involved in the adoption of the sustainable modes of walking, cycling, and public transport shows that physical and logistical infrastructure is a determining factor (see Javaid et al., 2020). For example, people are more likely to cycle when there is a good cycle path network with separate cycle lanes and when it is connected to other modes such as public transport (Buehler & Dill, 2016; McBain & Caulfield, 2018). Conversely, the better the car (highway) network, the more kilometres are travelled by car (Kitamura, 2009). Javaid and colleagues (2020) conclude that a transition to low-carbon mobility will occur only if cities are designed with an infrastructure to match. When cities consider shared transport as one of the established forms of mobility, it is important that this is taken into account in the design of the physical environment and infrastructure.

### **4. From car ownership to shared vehicle use: It ain't easy**

Shared transport is seen as one of the solutions for reducing CO<sub>2</sub> emissions from road traffic. This requires drivers to make the switch from private car ownership to shared transport. This literature review makes it clear that this behavioural change requires more than just the installation of shared vehicles. Various behavioural factors play a role in car owners' behavioural transition towards shared transport, with some factors stimulating the switch and other factors hindering it. From the insights gained in the literature review, we formulate five challenges that may impede the transition from private car ownership to shared transport. The five challenges are described below together with possible solutions.

#### **4.1 "Why should I?"**

Even if a situation is created in which shared transport is available to everyone, this is not a reason for many car owners to say goodbye to their own familiar and comfortable car. In general, car owners are satisfied with their current travel habits. They experience driving as comfortable and pleasant, and they are familiar with it. If car owners do not see any added value in switching to shared transport, the chances are small that they will do this of their own accord. Motivation can be influenced via two routes. The first route is by positioning the new option – electric shared transport – as more attractive than the existing travel routine. It must be clear what the switch will give car owners (for example, financially and in status), why it is attractive to them, and how it connects to their intrinsic values. The other route is by generating some discomfort or friction about current behaviour – using one's own fossil-fuel car. Research shows that ambivalence about a behaviour can be the beginning of a behaviour change process; ambivalence about the current behaviour must increase before new behaviours are adopted (Armitage et al., 2003). Several authors suggest



that generating ambivalence is a first and necessary step before behaviour change occurs (Van Harreveld et al., 2009; Berndsen & Van Der Pligt, 2003; Barata & Castro, 2013). Awareness of the disadvantages of the private car (cost, congestion, parking problems) or discomfort about the daily emission of CO<sub>2</sub> by the private car can also be a route to behaviour change.

#### **4.2 “Traveling by car is so easy, efficient, and comfortable”**

The physical environment in which shared transport is placed is of great importance in the success of shared transport as an alternative to the private car. Despite the fact that shared transport contributes to increasing sustainable travel options, it has so far not proved to be a gamechanger for making travel behaviour more sustainable. One reason for this is that the physical environment is still often designed in favour of the car. People use the car because this vehicle gets them from A to B quickly, easily, and comfortably. The design of the physical and the logistical environment, including the infrastructure, plays an important role in this. If cities are designed in such a way that there are disadvantages to owning and using a car, people are more likely to choose other travel options. Think of car-free city centres or limited parking space. A transition to low-carbon mobility will take place only if cities are designed with a low-carbon infrastructure. Simply placing shared vehicles on the street will not be enough. To really entice car owners to use shared transport, the entire physical city must be designed accordingly.

#### **4.3 “I always do it this way”**

Travel behaviour is largely habitual. The way people travel is often unconscious, they often do it on autopilot. This is especially true for frequently recurring trips, such as commuting. This unconscious, routine action process is a major barrier to changing travel behaviour and making it more sustainable. Ingrained habitual behaviour is not easily broken and, because there is no conscious decision moment, it is more difficult to move the car owner towards an alternative. In addition, the automatic process means that information about the advantages of shared transport is hard to get through to the target group. Routines and automatisms ensure that people can function without having to think about everything. However, the automatic process also guides the selection and interpretation of information. Because of an overload of stimuli, people are programmed to process mainly information that they consider relevant and to ignore that which is not in their area of interest or influence. As a result, when car owners are satisfied with the current status quo, they process primarily information that fits their existing (car) routines. When car owners are very comfortable with their existing situation, it is difficult to reach them with communication campaigns aimed at changing travel behaviour. A local or personal approach can then be more effective. In addition, situations where usual travel routines are broken, such as road works or moving house, can be exploited.

#### **4.4 “I don’t feel like going to all that trouble”**

Using new products or new services generally takes extra time and energy. For a person to take action, the expected investments must be outweighed by the subjective benefits of the change. Shared transport is a relatively new concept, where teething troubles are not unusual. If the (first) use of shared transport is accompanied by a lot of hassle, the chances are that people will drop out. Think of unclear processes surrounding the purchase of the service or the use of a vehicle or functionalities that do not work properly. The required investment is then too big compared with the familiar existing situation. This is especially the case when people are satisfied with the existing situation. As far as the investment is concerned, it is mainly about the target group’s

perception of this and not necessarily how it is in reality. People make trade-offs based on their own ideas and knowledge. The perceived investment can differ from the actual investment needed. Communication plays an important role here: people must have the confidence that using shared transport is not difficult and that transfers can be made without much fuss. It is important that this is actually the case. Incorrect expectation management leads to frustration and disappointment, which in turn causes people to cancel. Because car owners are quite attached to their own car, it may be useful to first introduce shared transport to target groups that are easier to seduce and are naturally interested and motivated in such a new technology. Think, for example, of people without a car, for whom the added value of shared transport is easier to communicate, of early adopters who want to be at the forefront of new products and technologies, or of people who are very environmentally aware and would like to travel more sustainably. With use by such an initial, motivated group, teething problems can be eliminated, costs reduced, and numbers scaled up. When a large group is already using shared transport, it makes adoption by the harder-to-reach group of car owners more likely.

#### 4.5 “Others (don’t) do it”

Owning and using one’s own car is still the standard at the moment. From behavioural sciences, we know that the prevailing social norm (‘what is normal and what others do’) is an important driver of behaviour. People do not like to deviate from what is considered normal and what others do. Cars are visible: they are visible on the road, traffic jams are a normal phenomenon, and carparks are full. Using shared transport is a deviant choice for most people. This is certainly the case with the most important target group – car owners – who must make the switch to reduce CO<sub>2</sub> emissions. To get people on board, the standard will have to shift; owning a car will have to be scaled down and shared transport will have to become the obvious choice. This can be done by linking more and more disadvantages to car ownership (for example by making it more expensive and by making the disadvantages for society very explicit) and by promoting shared transport as much as possible (for example by tax incentives and large-scale campaigns). In doing so, however, it is good to take three things into account:

- In general, car owners do not have a negative association with shared transport. Nevertheless, they often do not see themselves as a target group. They are generally happy with their own car and associate shared transport mainly with hassle and a low status, and not with flexibility, unburdening, and possibly lower costs. Communication about shared transport therefore plays an important role: unjustified prejudices and associations must be removed, so the message, channel, and sender must be tailored to the target group and context.
- The use of shared transport must be visible to car owners, creating the image that many others are already using it; that it is the new norm; where it helps that ‘others’ are people with whom car owners can identify. Just make sure that use is visible – not just parked, stationary vehicles. A shared transport hub with no activities communicates the opposite norm, which is that shared transport is not used. It may therefore make sense to initially invest heavily in pushing initial use, for example by offering a financially attractive trial offer. This will make use more normal and visible. It can also lead to habit formation, which increases the chances of the continued use of shared transport.
- Public transport must fit in with how people see themselves and with what they identify. Marketing and communication play an important role here and should actively respond to what the target group considers important; that it is tailor-made. What people respond to differs per sub-target group. People can be triggered by sustainability, status, quality of life, or money. It is therefore important to know what people from the target group identify with and what drives them. Contact with the target group, for example through target group research, is therefore essential.



## 5. Conclusion

With this literature review, we used existing scientific evidence to identify the behavioural factors for using shared transport. For example, people must have the right capacity and motivation, standards must be in line with shared transport use, and the physical environment must be well designed.

Despite the fact that the research was conducted carefully and systematically, some limitations must be taken into account. For example, during the search it became apparent that the number of articles on car owners' shared transport use was small. Also, studies on behavioural factors appeared to be non-existent, with a few exceptions. For the literature search, a broad search strategy was therefore used, identifying articles from various research fields. Consequently, results from these studies were not always easy to compare, because, as research shows, outcomes and conclusions are strongly dependent on the context and focus of the study. Consider, for example, differences between urban and rural areas or different sub-modalities. Follow-up research is needed to find out the extent to which results from different cities are generalisable. Finally, many behavioural studies use self-reports. These methods have limitations in terms of measurement reliability. For example, we know that people can unconsciously overestimate themselves and underestimate the role of external factors. Experiments with actual behavioural measurements are therefore needed.

The insights from the literature review allowed us to formulate several challenges that stand in the way of the behavioural transition towards shared transport use and that need to be overcome. Currently, the cost-benefit analysis that people perform is to the detriment of shared transport. In particular, car owners now do not see any added value in using shared transport compared with using their own car. Thus, people need to start seeing the added value of shared transport use, because it is important that communication about shared transport is relevant and fits the needs of the target group. The required investment must be outweighed by the (perceived) benefits: people must have both the idea and the actual experience of shared transport being simple, practical, and pleasant to use. It helps if shared transport use is normal and visible, because it is important that the car owner can identify with the visible users. Besides making shared transport more attractive, it is also about making owning and using a private car less attractive. The design of the physical environment and the policies implemented therefore also play an essential role. A multidisciplinary collaboration is consequently necessary.

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