Road to Sustainability: Factors Associated with Car-lessness and Car-sharing

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Abstract

Which factors are associated with circular consumption behavior in the field of mobility? To answer this question, we conducted a cross-sectional survey study with n = 72 participants. The questionnaire included items on egoistic and biospheric values, descriptive norms, personal norms, and the two outcome behaviors willingness to live car-less and willingness to use car-sharing instead of owning a car. We used simple linear regression to model the relationship between the variables and found that egoistic and biospheric values were associated with personal norms, which in turn were strongly positively associated with the two outcome behaviors. Furthermore, we found a positive association between descriptive norms and the outcome behaviors mediated by personal norms. Theoretical and practical implications can be derived from this, such as the importance of descriptive norms as antecedents of personal norms and thus, for pro-environmental behaviors, actions, and interventions. However, in order to determine the influence of the investigated determinants on circular consumption behaviors in the area of mobility more precisely, further studies and experiments showing causal relationships are indispensable.

Keywords: circular consumption behavior, car-sharing, personal norms, values, descriptive norms

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Climate change is progressing. According to the IPCC (2023), global warming between 1.4 and 4.4 degrees Celsius is projected by 2100, depending on future emissions of greenhouse gases. In this context, mobility plays a major role in the generation of CO_2 emissions. In 2019 road transportation accounted for almost 20% of the European Union's total CO_2 emissions, whereby the use of private vehicles was the largest contributor to total road traffic emissions (European Parliament, 2019). Therefore, in order to reduce these emissions and the consequences they have on the environment, the climate, and human health, the private transportation sector has to change, and action has to be taken.

Various concepts deal with sustainable alternatives which can also be applied to mobility. One model that has recently become increasingly prominent is the circular economy (CE). Kirchherr et al. (2017) summarize this as follows:

> (…) an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. (pp. 224-225)

In other words, CE strives for sustainable development with different strategies within different systems (Kirchherr et al., 2017). These strategies or principles are divided into three categories in the 9R Framework (Potting et al., 2017). First, some strategies focus on smarter product use and manufacture such as refuse, rethink, and reduce. The next 5 Rs: reuse, repair, refurbish, remanufacture, and repurpose aim to extend the lifespan of products and their parts.

Finally, there is the concept of useful application of materials, which is composed of recycling and recovering, and means, for example, that materials are not disposed of but rather reused for new products (Potting et al., 2017). The present work focuses on the micro- or consumer level because the consumer – in the case of mobility the private vehicle owner or user – has a large share in the CO_2 emissions emitted by the mobility sector and thus in the overall emissions (European Parliament, 2019). At this level, the study examines the strategies refuse and rethink, as these strategies are considered the most impactful (Kirchherr et al., 2017). Here, refusing is about not owning a private vehicle, in other words living or being car-less, and rethinking is about changing one's previous mobility behavior and using alternative forms of transportation, such as car-sharing instead of owning a car.

Car-sharing is the organized, joint use of a car by several people (Carsharing Association, 2022). There are different concepts of car-sharing, such as readily available vehicles in cities, to which one has access as a member and can rent them for a short period of time, or car-pooling where you ride with a friend or peer to school, work, or even on holiday. There is a debate about whether car-sharing actually is environmentally friendly. For example, if people use car-sharing in addition to their own car, this could of course lead to even more emissions. However, a study by Amatuni et al. (2020) took this rebound effect and its factors into account and was still able to find a reduction of 3 - 18% in greenhouse gas emissions when using car-sharing. Nonetheless, this study explicitly looks at car-sharing instead of car ownership. The aim is that people no longer own a car and only use one when they need it, for example by using car-pooling to get to work. This, and also choosing car-lessness, could reduce individual car use and fewer cars would have to be produced, which would result in less CO_2 emissions and therefore have a positive impact on the climate (Firnkorn & Müller, 2011).

From this, the question arises, what leads people to be willing to live car-less or use car-sharing instead of owning a car? Numerous models and theories in psychology, especially in social and environmental psychology, try to explain and predict pro-environmental behavior. This paper will mainly focus on the association between personal norms, biospheric and egoistic values, descriptive norms, and the outcome behaviors (see Figure 1), as previous research has already shown that these determinants seem to have a significant influence on other pro-environmental behaviors, such as choosing sustainable travel modes or purchasing sustainable apparel (De Groot et al., 2021; Farrow et al., 2017; Kim & Seock, 2019; Lind et al., 2015; Schultz et al., 2016; Stern, 2000; Stern et al., 1999).

Figure 1

Proposed model of the relationship between the variables.
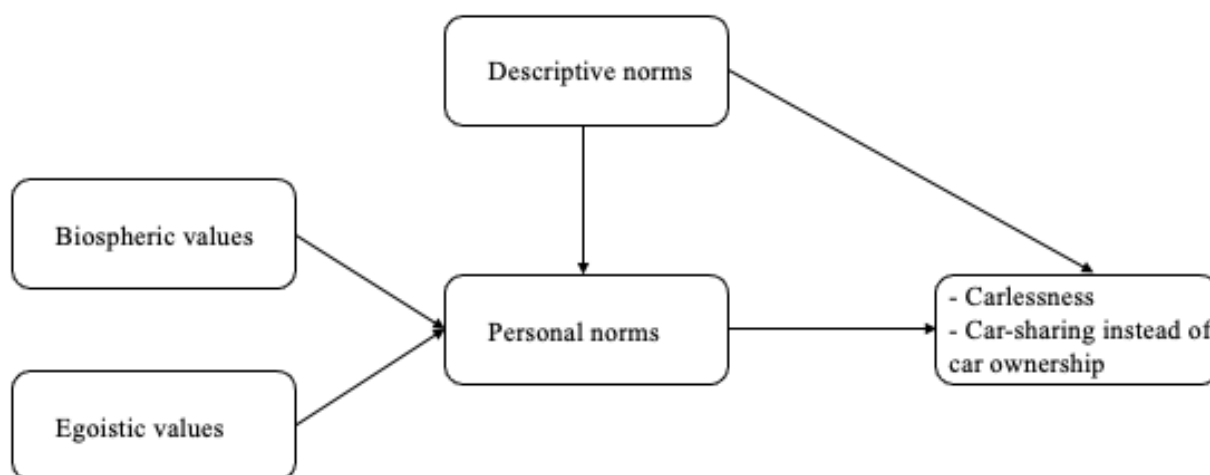
According to Schwartz (1977) and his norm-activation theory, personal norms are self-expectations, sanctions, and obligations rooted in internalized values. Personal norms are not only perceived as moral obligations to engage in decision-making processes and influence altruistic behavior when activated but they are also considered to have a strong positive influence on pro-environmental intentions and behaviors (Klöckner, 2013; Schultz et al., 2016). Harland et al. (1999) examined how personal norms are associated with various pro-

environmental behaviors, including using other transport modes than cars. The results showed that personal norms are a significant determinant in explaining using other transport modes than cars. A study by Mathies et al. (2006) also demonstrated that personal norms have a positive influence on alternative travel mode choices or at least on the intentions toward the behavior. However, it has not yet been examined whether personal norms are also related to the willingness to use car-sharing instead of owning a car, and also whether they are only related to the use of transport modes other than cars, but also to the willingness to live completely car-less. Therefore, the current study investigates this association, and the following hypotheses arise:

H1a: Stronger personal norms are associated with willingness to live car-less.

H1b: Stronger personal norms are associated with willingness to use car-sharing instead of owning a car.

One factor that appears to have a strong influence on personal norms and pro-environmental behavior is values (De Groot & Steg, 2007, 2008; Steg et al., 2014; Stern, 2000; Stern et al., 1999). Values can be defined as guiding principles, standards, or goals of an individual (Schwartz, 1992). According to the value belief norm theory of environmentalism (VBN; Stern, 2000; Stern et al., 1999) values influence behavior through certain pro-environmental beliefs and personal norms. In the VBN, these values are specified in three types, namely egoistic, altruistic, and biospheric values (Stern, 2000; Stern et al., 1999). People with strong egoistic values are mostly concerned about the consequences of their actions on personal resources, whereas individuals with strong biospheric values are more focused on the impact of their actions on the environment and nature. Therefore, we will mainly focus on egoistic and biospheric values, and not on altruistic values, as circular mobility behavior often entails consequences and impacts for the individual personally and on

the environment, which in essence constitutes the two values. The influence of values on behavior in the mobility sector has empirical support. Nordlund and Garvill (2003) showed that ecocentrism, which is comparable to biospheric values, has a moderate to strong effect on the willingness to reduce personal car use, mediated by personal norms. Further, a study by Lind et al. (2015) showed that biospheric values are a strong predictor of personal norms, which in turn predict a sustainable travel mode choice. As previous research indicates a relationship between values and personal norms, we test this relationship again to be able to make more precise implications, particularly in the field of mobility and circular consumption behaviors in general. Therefore, we propose the following hypotheses:

H2a: Higher biospheric values are associated with stronger personal norms.

H2b: Higher egoistic values are associated with weaker personal norms.

According to recent research, social norms also appear to have a direct relationship with pro-environmental behavior (Farrow et al., 2017). Social norms are generally understood as shared rules or social beliefs about behavior (Elster, 1989). There are different types of social norms, for example, injunctive and descriptive norms. This study will focus on descriptive norms. Descriptive norms refer to what most or 'typical' people do and therefore relate to the motivation to consider 'normal' behavior as evidence of what may be effective or adaptive (Cialdini et al., 1990, 2006). Previous studies have already shown that there is a relation between descriptive norms and individual mobility behavior, specifically car use (Gardner & Abraham, 2007; Hoffmann et al., 2017). Further, a meta-analysis by Lanzini and Khan (2017) showed positive correlations between the perceived descriptive norm of not using a car and choosing alternative transport modes, such as cycling or using public transport. The modes of transportation studied so far did not include car-sharing or living car-less in general. Hence, we examine whether this alternative is also related to descriptive

norms, although it is not a behavior that is as clearly perceived and known as sustainable as, for example, cycling. For this reason and as already described above, we focus explicitly on 'car-sharing instead of owning a car', to emphasize that this is considered a sustainable alternative. Accordingly, we will test the following two hypotheses:

H3a: Stronger descriptive norms are associated with willingness to live car-less.

H3b: Stronger descriptive norms are associated with willingness to use car-sharing instead of owning a car.

Social norms also seem to be an important antecedent of personal norms (Klöckner & Blöbaum, 2010). Klöckner (2013) showed in a meta-analysis that social norms have a significant positive impact on personal norms. Social norms could affect personal norms, as personal norms are formed, partly, by internalizing social norms and adapting them to one's personal value system (Klöckner & Blöbaum, 2010, Thøgersen, 2006, 2009). Further, studies have shown that personal norms mediate the influence of social norms on pro-environmental behaviors (Biel & Thøgersen, 2007; de Groot et al., 2021; Kim & Seock, 2019, Thøgersen, 2006, 2009). Studies investigating the influence of social norms on pro-environmental travel or mobility behavior showed, for example, that social norms mediated by personal norms have an impact on the decision to buy a fuel-efficient car (Nayum & Klöckner, 2014). Further, a study by Bamberg et al. (2007) found that social norms are strongly associated with personal norms which predict the use of public transportation. However, whether personal norms mediate the relation of descriptive norms on our specific outcome variables has not been studied yet, leading to the following hypotheses:

H4: Stronger descriptive norms are associated with stronger personal norms.

H5a: Personal norms mediate the relationship between descriptive norms and willingness to live car-less.

H5b: Personal norms mediate the relationship between descriptive norms and willingness to use car-sharing instead of owning a car.

Methods

Participants

The study comprised a convenience sample of n = 140 participants. After excluding participants who did not agree to participate, did not complete the study, or failed at least one of the three attention checks, the final number of participants was n = 72. The participants were between 18 and 56 years old, with a mean age of 24.25 years. The participants were 39 females, representing 54.2% of the sample, and 32 males, representing approximately 44.4%. One person reported another gender or did not want to tell their gender, making up 1.4%. Most participants, 45.8% stated higher education (WO) as their highest level of education, followed by 40.3% for secondary school (VWO/HAVO). Only 1.4% of the sample stated secondary school (VMBO/MAVO) as their highest level of education. The household's monthly net income was less than €1499 for the majority of the sample (41.7% of the sample), followed by household income between €1500 and €2499 (16.7% of the sample). Of the participants, 6.6% stated that their household income was higher than 5000€. A major proportion of the participants (44.4%) lived in an area with around 100,000 – 250,000 residents, followed by 26.4% of participants living in an area with 250,000 – 1,000,000 residents. Only six participants (8.3%) reported to live in areas with over 1,000,000 residents.

Procedure

This survey study was conducted by two students for their bachelor thesis project and was ethically approved by the Ethics Committee of Psychology of the University of Groningen. The data collection took place from December 6, 2023, to January 3, 2024. Participants were recruited using all kinds of social media such as LinkedIn, Instagram, and

WhatsApp, where a flyer and a link were sent out or posted. Further, incentives were used to appeal to different groups of people and not just people who are generally interested in environmental topics. Participants could take part in a giveaway of three Amazon.com vouchers worth €20 each, and 18 trees were planted in the Dutch forest and Indonesian rainforests. After completing the questionnaire, participants were free to decide whether they wanted to take part in the giveaway, whereby the email was stored independently of the collected data.

The questionnaire itself was carried out via the online survey platform Qualtrics (https://www.qualtrics.com) and took around 20 - 30 minutes to complete. In the first part, participants had to answer various questions covering the determinants: values (biospheric, egoistic, altruistic), problem awareness, attribution of responsibility, self- and outcome efficacy, personal norms, and social norms. The participants were then asked about various circular consumption behaviors in the field of mobility (car ownership, car-sharing, and flying) and housing. At the end of the study, demographic data was collected on age, gender, highest level of education, number of household members, household composition, population density of the residential area, and household monthly net income. However, in the current study, we only focused on: egoistic and biospheric values, descriptive norms, personal norms, car ownership, and car-sharing. The data was processed and analyzed using IBM SPSS Statistics (Version 28).

Measures

For values, 16 different value constructs based on Steg et al. (2014) were used, which were surveyed using a rating scale ranging from -1 to 7. -1 means the value is opposed to the principles that guide you, 0 means the values are not important at all or irrelevant as a guiding principle of your life, 3 means the values are important and 7 means the values are of supreme

importance as guiding principle in your life. The following is an example of an egoistic value: "AUTHORITY: the right to lead or command" and examples of biospheric values are: "RESPECT FOR THE EARTH: harmony with other species" or "PROTECTION OF THE ENVIRONMENT: preservation of nature". Cronbach's alpha for the biospheric values scale was good $\alpha = .86$ ($M = 4.701$, $SD = 1.385$), and for the egoistic values scale also was good, $\alpha = .78$ ($M = 2.805$, $SD = 1.383$).

Personal norms were assessed based on statements from Sharpe et al. (2022) about circular consumption ranging from, for example, "I feel morally obliged to engage in circular consumption behaviours." to "I would violate my principles if I did not engage in circular consumption behaviours.". Participants had to indicate to which extent they agreed with these statements using a seven-point Likert scale (*strongly disagree - strongly agree*). Cronbach's alpha for this scale was good, $\alpha = .88$ ($M = 4.608$, $SD = 1.254$).

The descriptive norms were measured using statements about circular consumption behaviors using a seven-point Likert scale (*strongly disagree - strongly agree*). The following items were used: "Most Dutch people engage in circular consumption behaviours.", "Most of my close contacts, e.g., my friend and partner, engage in circular consumption behaviours.", and "Most of my family members engage in circular consumption behaviours.". Cronbach's alpha for this scale was sufficient, $\alpha = .61$ ($M = 3.616$, $SD = 1.161$).

The examined circular consumption behaviors addressed mobility, i.e., willingness to live car-less and willingness to use car-sharing instead of owning a car. Participants were asked about their car ownership and car-sharing behavior, with questions based on Firnkorn and Müller (2011) on willingness: "Are you willing to not own a car?" ($M = 3.390$, $SD = 1.379$) and "Are you willing to use car sharing instead of owning a car in the future?" ($M = 3.430$, $SD = 1.173$) using a 5-point Likert scale (*definitely not - definitely yes*).

Results

First, we tested hypotheses H1a and H1b using simple linear regression. Both hypotheses, that stronger personal norms are associated with the outcome behaviors, were supported by the data (willingness to live car-less: $R^2 = .159$, $F(1, 70) = 13.220$, $\beta = .399$, $p < .001$; willingness to use car-sharing instead of owning a car: $R^2 = .149$, $F(1, 70) = 12.274$, $\beta = .386$, $p < .001$). This indicates that stronger personal norms are associated with a higher willingness to live car-less and to use car-sharing instead of owning a car.

The second hypotheses, that (2a) higher biospheric values are associated with stronger personal norms and (2b) higher egoistic values are associated with weaker personal norms, were also tested using simple linear regression. Biospheric values and personal norms were statistically significantly related ($R^2 = .200$, $F(1, 70) = 17.511$, $\beta = .447$, $p < .001$), supporting hypothesis 2a. Egoistic values, on the other hand, were not significantly, yet weakly negatively correlated with personal norms ($R^2 = .048$, $F(1, 70) = 3.441$, $\beta = -.218$, $p = .066$). However, when both variables are added into one multiple regression model, the results for both variables were statistically significant ($R^2 = .250$, F(1, 69) = 11.510) with $\beta = .450$, $p < .001$, for biospheric values and $\beta = -.224$, $p = .035$, for egoistic values. The overall result indicates that higher biospheric values are associated with stronger personal norms and higher egoistic values are associated with weaker personal norms.

For hypotheses 3a and 3b, we examined the association of descriptive norms with the two outcome behaviors. Hypothesis 3a was confirmed ($R^2 = .072$, $F(1, 70) = 5.398$, $\beta = .268$, $p = .023$), which indicates a positive association between descriptive norms and willingness to live car-less. The association between descriptive norms and willingness to use car-sharing instead of owning a car was also positive and significant ($R^2 = .077$, $F(1, 70) = 5.881$, $\beta = .278$, $p = .018$). Taken together, the results suggest that higher descriptive norms are

associated with both behaviors, willingness to live car-less and willingness to use car-sharing instead of owning a car.

Our fourth hypothesis was that stronger descriptive norms are associated with stronger personal norms. Consistent with our hypothesis, linear regression analysis showed that descriptive norms were significantly associated with personal norms (R^2 = .2, $F(1, 70)$ = 17.553, β = .448, $p < .001$). This indicates that personal norms are stronger when descriptive norms are stronger.

Lastly, the fifth hypotheses, that the relationship between descriptive norms and the two outcome behaviors is mediated by personal norms was tested. Therefore, we first conducted a multiple linear regression to test the correlation between the two independent variables, descriptive norms, and personal norms, and the two outcome behaviors. The overall model for the first outcome behavior, willingness to live car-less, was statistically significant (R^2 = .169, $F(1, 69)$ = 7.006, p = .002). For the second outcome behavior, willingness to use car-sharing instead of owning a car, the overall regression was also statistically significant (R^2 = .163, $F(1, 69)$ = 6.723, p = .002). To calculate the mediation using the Sobel test (Sobel, 1982), the unstandardized coefficients B and the coefficients standard errors of the models are used to calculate the Sobel-Test statistics and the point effects (see Figure 2). For the first outcome behavior, willingness to live car-less, the Sobel-Test statistic was 2.352 (SE = .079) and the point effect was .185 with p = .019, which indicates that personal norms mediate the association between descriptive norms and willingness to live car-less. Hypothesis 5b, was also supported by the test, with a Sobel-Test statistic of 2.249 (SE = .065), and a point effect of .148 with p = .024. This also indicates that the association between descriptive norms and the outcome variable, willingness to use car-sharing instead of car ownership, is mediated by personal norms.

Figure 2

Mediation model
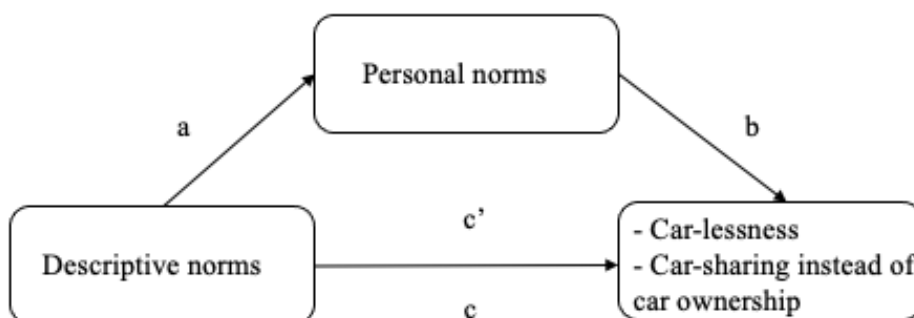
Note. The figure shows the mediation model with descriptive norms as explanatory variable, personal norms as mediator, and willingness to live car-less and willingness to use car-sharing instead of owning a car. The coefficients in the model are unstandardized. For H5a (car-lessness): a = 0.484** , b = 0.383** , c = 0.132, c' = .185*; For H5b (car-sharing instead of car ownership): a =0.484**, b = 0.306**, c = 0.137, c' = .148* (c' = point effect, *p < .05, **p < .01).

Exploratory Analysis

Independently of our hypotheses, we also conducted exploratory data analyses. We tested correlations between the measured demographics and the two outcome behaviors. In addition, we tested the point-biserial correlation between current car ownership (*yes* or *no*) and the two outcome behaviors. For the demographics, level of education, and density of the residential area, the correlations with the outcome behaviors were not significant. However, for household monthly net income and willingness to use car-sharing instead of owning a car, the correlation was significantly negative (r (70) = -.276, 95% CI [-.477, -.048], p = .019). This indicates that people with a higher household monthly net income are associated with a lower willingness to use car-sharing instead of owning a car.

Of the 72 participants, 28 owned a car (38.9%) and 44 participants did not own a car (61.1%). The point-biserial correlation between current car ownership and willingness to live car-less was r_{pb} (70) = -.455, 95% CI [-.621, -.250], $p < .001$ and with willingness to use car-sharing instead of owning a car the point-biserial correlation was r_{pb} (70) = -.270, 95% CI [-.473, -.041], $p = 0.22$. These results indicate that present car ownership is significantly negatively correlated with both outcome behaviors.

Discussion

This study aimed to investigate determinants related to circular consumption behaviors in the domain of private car use/ mobility behavior, more specifically, willingness to live car-less and willingness to use car-sharing instead of owning a car. We found a strong positive association between personal norms and the two outcome behaviors. Moreover, egoistic and biospheric values were associated with personal norms. While higher biospheric values had a statistically significant positive correlation with personal norms, higher egoistic values had a non-significant but still weak negative correlation with personal norms. Furthermore, we found an association between descriptive norms and personal norms and both outcome behaviors. In addition, our analysis showed that personal norms mediated the association between descriptive norms and the two outcome behaviors. Lastly, we conducted an exploratory analysis, which showed a negative correlation between household monthly net income and willingness to use car-sharing instead of owning a car. Further, the exploratory analysis revealed negative point biserial correlations between current car ownership and both outcome behaviors.

Theoretical implications

Consistent with our first hypotheses, stronger personal norms were associated with willingness to live car-less and willingness to use car-sharing instead of owning a car. This is

in line with environmental psychology theories, such as the VBN (Stern, 2000; Stern et al., 1999) and the norm-activation theory (Schwartz, 1977), and the studies by Klöckner (2013) and Schultz et al. (2016), which assume positive correlations between personal norms and pro-environmental behaviors. Previous studies already found associations between personal norms and the usage of other alternative transport modes (Harland et al., 1999; Mathies et al., 2006). By examining the influence of personal norms on these specific and yet untested behaviors, namely car-sharing and car-lessness, we extend the knowledge about the applicability of these theories on circular mobility behaviors and further, strengthen these theories. In conclusion, our results argue for a generalized application of personal norms as an important determinant of pro-environmental, or circular consumption behaviors.

Secondly, as we hypothesized, biospheric values were positively associated with personal norms. This implies that the more important the participants considered the environment, or the consequences of their actions on the environment, the more they felt an obligation to engage in circular mobility behavior. Many studies emphasize the importance of values for understanding pro-environmental beliefs, norms, and behavior (De Groot & Steg, 2007, 2008; Kim & Seock, 2019, Stern, 2000). Our finding supports previous research on biospheric values as an antecedent of personal norms (Lind et al., 2015; Nordlund & Garvill, 2003) as well as the VBN (Stern, 2000; Stern et al., 1999). For Hypothesis 2b, that stronger egoistic values are associated with weaker personal norms, our results were only significant in the multiple regression model, including biospheric values, but not in the simple linear regression model. Either way, a weakly negative correlation was found. This result is in line with most research on the association between egoistic values and pro-environmental behaviors or personal norms (De Groot & Steg, 2007, 2008; Nordlund & Garvill, 2003; Steg et al., 2014). Since egoistic values are about reducing the consequences for oneself or maximizing personal gains, and pro-environmental behaviors are often associated with costs and restrictions, these

results are quite reasonable. However, contrary to our findings, Kim and Seock (2016) found a positive association between egoistic values and personal norms. They argued that if one's quality of life is improved or protected by acting pro-environmentally, egoistic values could have a positive effect on pro-environmental behavior. Possible reasons for the different findings could be that people are not yet sufficiently aware of the long-term effects of climate change on their own lives. Further research on this is necessary.

The third hypotheses, that stronger descriptive norms are associated with willingness to live car-less and willingness to use car-sharing instead of owning a car, were also supported. This is in line with previous research on descriptive norms and individual mobility behavior (Gardner & Abraham, 2007; Hoffmann et al., 2017). Moreover, it is interesting that although car-sharing is not an alternative mode of transport like cycling, as investigated in Lanzini and Khan's (2017) study, which is a more 'normal' or widely known sustainable mode of transport, the descriptive norms nevertheless correlate with it. Since we explicitly stated 'car-sharing instead of owning a car', this might have made the pro-environmental impact of this behavior clearer. However, our analysis showed that the association of descriptive norms and the two outcome behaviors is mediated by personal norms, and this is of great importance. This supports the idea that descriptive norms and personal norms are strongly linked, which is consistent with previous research that social norms are an important precursor to personal norms and that personal norms are partly shaped by internalized social norms (Klöckner & Blöbaum, 2010; Thøgersen 2006, 2009). Social norms seem to have an important role in the engagement of different pro-environmental behaviors directly and indirectly through developing personal or moral obligations to behave pro-environmentally, in this case, using car-sharing instead of owning a car and living car-less. For this to be the case, however, it is important that social norms need to be internalized first.

Practical Implications

From this study, practical implications can be drawn for policy measures in the field of sustainable mobility, but also for companies that want to promote car-sharing more effectively. Since personal norms can be understood as moral obligations (Schwartz, 1977), people are likely to act upon them, as not acting upon them may induce feelings of guilt. Policies should therefore aim to activate personal norms by making people aware of the positive environmental impact of living car-less or using car-sharing instead of owning a car. Campaigns could for example focus on actively communicating that by using car-sharing instead of owning a car, one contributes to the reduction of a certain amount of CO_2 emissions, which has a positive impact on the environment.

Since descriptive social norms have an influence on personal norms, and thus on moral obligations to live car-less or use car-sharing these could also be used by policymakers or advertisements for car-sharing. In this context, it is important to target what is considered normative, i.e., what other people normally do. The visibility of car-less living and car-sharing companies must therefore be significantly extended. This could be achieved with an increased quantity of advertisements, but also with clearly visible differences in the urban infrastructure. If it is perceived that there are hardly any private cars on the road, but only car-sharing vehicles, it should change the perception of the social norms and has a positive effect on personal norms and thus on behavior.

Limitations

This study has potential limitations. This study only measured the willingness to engage in these behaviors, not the actual behaviors. Willingness, similar to intention, is a process that precedes a certain behavior (Gerrard et al., 2008) Therefore, the intention-behavior gap, or in environmental topics also called the green gap, i.e., the difference between the concern about the environment and what is actually done to act environmentally friendly,

should not be ignored (ElHaffar et al., 2020). According to Carrington et al., (2014), factors like prioritization of ethical concerns, formation of plans/habits, and willingness to commit and sacrifice, should be considered in the area of ethical consumption. However, according to the theory of planned behavior (Ajzen, 1991), willingness or intention nevertheless is a direct and accurate predictor of behavior.

Another limitation is that we disregarded some factors, that may influence the outcome behaviors, especially the use of car-sharing. For example, people are often concerned about monetary costs or accessibility. In addition, we had a very mixed sample in terms of age, income, and density of the cities in which the participants live. On the one hand, this was good in order to have a broader cross-section of society, but on the other hand factors such as the size of the city in which the participants live, or their financial status could also have influenced the behaviors. Based on the exploratory analysis, we were only able to establish an association with the latter, but it cannot be ruled out that people who live in a large city with a better-developed public transport network, for example, are less dependent on car-sharing or car ownership.

Finally, the cross-sectional design does not allow us to draw conclusions about the causality or directionality of the relationships. This means that we cannot determine which variable influenced the other, as we are unable to establish temporal precedence in this design. However, the study aimed to establish whether there is a relationship between the determinants and the willingness to engage in the two circular consumption behaviors of living car-less and using car-sharing instead of owning a car. Ultimately, we were able to show this correlation and demonstrate the applicability of these determinants on these behaviors.

Recommendations for Future Research

As already mentioned in our limitations, it is crucial to measure actual behavior and not only willingness or intention. Willingness is only a precursor of actual behavior. We cannot be certain with this study what behavior the participants will eventually engage in. Therefore, future research should measure actual behavior with questions about past behavior or by using experimental, quasi-experimental, or longitudinal designs.

Conducting experiments or longitudinal studies would also be relevant to establish causal relationships between the determinants and the choice of sustainable transportation modes, to provide better insight and applicability of the factors. As already described, there are assumptions that the influence of egoistic values on personal norms can also be positive if the person perceives consequences for themselves due to environmental factors (Kim & Seock, 2019). In times in which people are becoming more aware of the consequences of the environment on their personal lives, it would be interesting to conduct further research on this determinant as well.

Lastly, we found an association between monthly income and the willingness to use car-sharing in our exploratory analysis. We also found significant correlations between current car ownership and both outcome behaviors. Future research should therefore not ignore factors such as income and current car ownership, as these might be positively or negatively associated with willingness to engage in the two behaviors. However, other factors such as the availability of car-sharing or other alternatives and costs should also be considered, as these could also influence choices and behaviors.

Conclusion

Climate change is progressing, and private transportation has enormous contributions to the emissions of CO_2. Therefore, we examined which factors are associated with environmentally friendly transport mode alternatives, such as living car-less or using car-

sharing instead of owning a car. Our findings contribute to a growing body of evidence suggesting that values, descriptive norms, and personal norms are important factors associated with pro-environmental or circular consumption behaviors, in the mobility sector. Further, we found evidence of the mediating role of personal norms between descriptive norms and circular consumption behaviors. This supports previous research on the role of descriptive norms on personal norms and thus on pro-environmental and circular consumption behaviors. From this, theoretical and practical implications can be drawn. The importance of descriptive norms and the mediating role of personal norms should not be ignored in the area of circular consumption behavior by both future research and policy makers. We recommend future research on the causality of these factors in order to draw more precise inferences.

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